

MORRIS LLOYD MINEANNUAL REPORTYEAR 19308. COST OF OPERATINGDetailed Cost Comparison:Stopping

	Amount	Per Ton.
Year 1930	189,611.40	.407
Year 1929	<u>170,890.57</u>	<u>.392</u>
Increase	18,720.83	.015

The above costs are subdivided as follows:-

	Year 1930		Year 1929	
<u>Supplies</u>	Amount	Per Ton	Amount	Per Ton
General Supplies	6,032.78	.013	4,955.28	.011
Iron & Steel	1,764.27	.004	2,231.51	.005
Oil & Grease	359.72	.001	274.66	.001
Machinery Supplies	16,270.74	.035	17,362.46	.040
Explosives	25,448.42	.055	25,764.21	.059
Lumber & Timber	164.56		87.82	
Electric Power	1,931.65	.004	1,566.03	.004
Sundries	221.32		29.17	
Shop Labor & Teaming	<u>1,335.42</u>	<u>.003</u>	<u>1,469.68</u>	<u>.003</u>
Total Supplies	53,528.88	.115	53,740.82	.123
<u>Labor</u>				
Payroll Labor	127,734.66	.274	107,366.34	.247
Shop Labor & Teaming	<u>8,347.86</u>	<u>.018</u>	<u>9,783.40</u>	<u>.022</u>
Total Labor	136,082.52	.292	117,149.74	.269
Grand Total	189,611.40	.407	170,890.56	.392

The foregoing table shows that the supply cost per ton was reduced in 1930, but that the labor cost shows an increase. The increase occurred in the first 5 months of the year, and is due to too high wages paid to contract miners. After the rate per car was reduced to the proper level, the cost was brought down.

Timbering

	Amount	Cost Per ton
Year 1930	89,292.17	.192
Year 1929	<u>88,467.62</u>	<u>.203</u>
Increase	824.55	
Decrease		.011

The cost per ton shows a slight decrease for 1930. Two important changes in method of timbering were made during the year. The length of the legs for the timber sets on sub levels was increased to 9 feet and wire netting used for floor lagging.

Tramming

Year 1930	53,563.81	.115
Year 1929	<u>56,358.76</u>	<u>.127</u>
Decrease	2,794.95	.012

This account shows a decrease due to less track cleaning because of the introduction of the new 4 ton rocker dump cars. There was also a reduction in the cost for chutemen. The old system of having chutemen stationed at various points in the ore crosscuts was changed and chutemen were instructed to ride with the motormen and brakemen.

MORRIS LLOYD MINEANNUAL REPORTYEAR 19301. COST OF OPERATINGDetailed Cost Comparison

<u>Ventilation</u>	Amount	Cost Per Ton
Year 1930	283.41	
Year 1929	<u>45.73</u>	
Increase	237.68	

Increase due to installing ventilating fan at the top of the 6th level, Morris Shaft second outlet and building doors at various points on the 6th level, to improve the circulation on the 7th level.

Pumping

Year 1930	17,771.50	.038
Year 1929	<u>16,632.69</u>	<u>.038</u>
Increase	1,138.81	

Cost for 1930 increased while the amount of water pumped decreased from 236,102,174 gallons in 1929, to 224,981,368 gallons in 1930. The amount of water pumped was less, because of the small precipitation especially during the summer and fall months. The cost increased, because a larger amount of water was pumped from the new 8th level. This level ran into a heavy flow of water, which required the use of another pumpman part time. For the past few years, the pumpmen have worked only two 8 Hr. shifts and this was increased to three 8 Hr. shifts. A detail of the operating expense follows:-

	1930	1929
Pumpmen Labor	\$ 4,915.65	\$ 4,422.20
Other Labor	180.05	147.57
Total Labor	<u>5,095.70</u>	<u>4,569.77</u>
Oil, Waste & Packing	395.84	523.36
Tools & Miscellaneous Supplies	93.91	342.81
Proportion of Air Charge	600.00	600.00
Electric Power	<u>11,586.05</u>	<u>10,596.75</u>
Total Supplies	<u>12,675.80</u>	<u>12,062.92</u>
Total Operating Expense	17,771.50	16,632.69
Gallons of Water Pumped	224,981,368	236,102,174

Compressors & Air Pipes

Year 1930	47,184.45	.101
Year 1929	<u>43,378.12</u>	<u>.100</u>
Increase	3,806.33	.001

MORRIS LLOYD MINEANNUAL REPORTYEAR 19308. COST OF OPERATINGDetailed Cost Comparison

The detailed cost of operating the compressors for the past two years follows:-

	1930	1929
Engineers Labor	\$ 4,080.83	\$ 4,072.82
Other Labor		15.18
Total Labor	<u>4,080.83</u>	<u>4,088.00</u>
Tools & Miscellaneous Supplies	15.57	
Water	392.29	1,691.41
Electric Power	36,369.27	32,172.09
Oil, Waste & Packing	254.18	254.09
Heating Expense	481.56	418.35
Total Supplies	<u>37,512.87</u>	<u>34,535.94</u>
Total Operating Expense	41,593.70	38,623.94
Increase for 1930	2,969.76	
Cost Per 1000 Cu. Ft.	.039	.042

The reason for the increased operating expense is largely due to running the compressors overtime for the rock drifting gang. In order to complete their cycle of two cuts per shift it is necessary to work overtime.

The new rock Drifts on both the 6th and 8th levels were equipped with new 4" pipe and the cost of this pipe and its installation accounts for the balance of the increase in this account.

Underground Superintendence

	Amount	Cost Per Ton
Year 1930	16,742.39	.036
Year 1929	<u>15,064.05</u>	<u>.035</u>
Increase	<u>1,678.34</u>	<u>.001</u>

Cost increased, because of change in Captains and because two Captains overlapped in February. Also because of more overtime worked by shift bosses and safety bonus paid to the bosses.

Compressors And Power Drills

Year 1930	4,615.07	.010
Year 1929	<u>3,313.67</u>	<u>.007</u>
Increase	<u>1,301.40</u>	<u>.003</u>

A detail of the cost of maintenance of compressors follows:

Year 1930	2,891.18
Year 1929	<u>1,221.48</u>
Increase	<u>1,669.70</u>

The Nordberg compressor was rebuilt, in 1930 at a cost of \$1,582.01 that is the old valve gear was taken off and the feather valves substituted.

In 1930 we purchased 2 N-75 Drifters at a Cost of \$700.00, also six RB-12 at \$170.00 Each.

Electric Tram Equipment

Year 1930	27,850.03	.060
Year 1929	<u>17,667.61</u>	<u>.041</u>
Increase	<u>10,182.42</u>	<u>.019</u>

MORRIS LLOYD MINEANNUAL REPORTYEAR 19308. COST OF OPERATINGDetailed Cost ComparisonElectric Tram Equipment

The cost of maintaining and replacements of electric Haulage system for the past two years follows:

	1930	1929
Generator	99.91	553.86
Locomotives	3,373.81	2,995.67
Wiring	2,588.41	1,762.91
Main Line Tracks	9,906.04	6,628.96
Main Line Cars	11,845.34	5,726.21
Spotting Engines	36.52	
	<u>27,850.03</u>	<u>17,667.61</u>

The labor cost in the above accounts for 1929 totalled \$8,128.52, and for 1930 \$8,542.36, so that the increase for the year 1930 is practically all in the supply items.

One second hand locomotive was purchased from the Crosby Mine for \$500.00 in 1930. Wiring shows an increase because of the substitution of 4/0 trolley wire for the old 2/0 wire. Because of the heavy load thrown on the trolley wire by the Electric Scraper Hoists it was decided to replace all the small trolley wire on the main working levels with the 4/0 size.

In 1929 only one 4 ton Rocker Dump Car was charged out, but in 1930, 16 Cars were charged out at a cost of \$485.00 each.

Pumping Machinery

	Amount	Cost Per Ton
Year 1930	2,155.51	.005
Year 1929	<u>14,286.81</u>	<u>.033</u>
Decrease	<u>12,131.30</u>	<u>.028</u>

The expense for 1929 was unusually heavy because of the cutting of the new pump house and sump on the 8th level Morris shaft. The cost for 1930 was below normal because repairs on the pumps were unusually light.

Hoisting

Year 1930	27,312.64	.059
Year 1929	<u>25,901.19</u>	<u>.060</u>
Increase	1,411.45	
Decrease		.001

The detailed costs of operating the hoisting plants for 1929 and 1930 follow:

	1930	1929
Engineers Labor	8,447.13	8,845.38
Other Labor	13.53	
Total Labor	<u>8,460.66</u>	<u>8,845.38</u>
Oil, Waste and Packing	183.13	191.54
Tools, Etc.,	131.82	95.67
Electric Power	17,565.60	16,029.57
Heating Expense	<u>971.43</u>	<u>739.03</u>
Total Supplies	<u>18,851.98</u>	<u>17,055.81</u>

The most of the increase in cost is confined to the electric power charge which increased about 9%. The tonnage of rock and ore hoisted increased from 455,989 tons in 1929, to 491,255 tons in 1930 an increase of about 8%.

Stocking Ore

Year 1930	13,097.35	.028
Year 1929	<u>10,290.31</u>	<u>.024</u>
Increase	<u>2,807.04</u>	<u>.004</u>

MORRIS LLOYD MINEANNUAL REPORTYEAR 19308. COST OF OPERATINGDetailed Cost ComparisonStocking Ore (Continued)

Increased because more or less ore was stocked all the months of the year. There was not a single month in which all the production hoisted was shipped from the pockets. In 1929 pocket shipments averaged nearly 100% during the entire shipping season.

Screening & Crushing at Mine

	Amount	Per Ton
Year 1930	3,522.30	.007
Year 1929	<u>2,596.41</u>	<u>.006</u>
Increase	925.89	.001

Cost increased because of repairs to Lloyd Shaft Crusher. New Bevel gear and pinion and new dust collar installed during the summer of 1930.

Dry House

Year 1930	10,164.64	.022
Year 1929	<u>11,672.62</u>	<u>.027</u>
Decrease	1,507.98	.005

Cost decreased because the Section six dry was closed down in the fall and all the men transferred to the Morris Shaft Dry.

General Surface Expense

Year 1930	6,411.78	.014
Year 1929	<u>5,302.73</u>	<u>.012</u>
Increase	1,109.05	.002

Increase due to charging a proportion of the Chief of police salary to surface expense and also improvements on office grounds.

HOISTING EQUIPMENT

Year 1930	4,750.58	.010
Year 1929	<u>4,667.38</u>	<u>.011</u>
Increase	83.20	
Decrease		.001

The costs for the two years are practically identical. The biggest single item is hoisting ropes and an equal amount were charged out each year.

Shaft

Year 1930	4,494.93	.010
Year 1929	<u>2,217.41</u>	<u>.005</u>
Increase	2,277.52	.005

The Morris shaft was repaired for 250 feet between the 6th and 7th levels. New timber of a value of \$565.00 was used and 5000 feet of new runners installed in the shaft.

Top Tram Equipment

Year 1930	1,997.33	.004
Year 1929	<u>948.20</u>	<u>.002</u>
Increase	1,049.13	.002

Cost for 1929 was below normal. Cost for 1928 was \$2,014.53 and for the previous year \$2,494.03 so that the 1930 cost was still below the normal maintenance figure. The cost for 1930 includes 2 new 4000 foot top tram ropes and one spare set of drums for the top tram engines.

MORRIS LLOYD MINEANNUAL REPORTYEAR 19308. COST OF OPERATINGDetailed Cost ComparisonDocks, Trestles & Pockets

	Amount	Cost Per Ton
Year 1930	510.16	.001
Year 1929	<u>488.78</u>	<u>.001</u>
Increased	21.38	

Cost for the past two years considerably below normal of previous years. The permanent and wooden trestles are however in such condition that modern steel trestles will have to be erected to replace them soon.

Mine Buildings

Year 1930	6,194.06	.014
Year 1929	<u>4,564.87</u>	<u>.010</u>
Increase	1,629.19	.004

A detail of the cost of repairs to Mine Buildings for Past two years follows:

	1930	1929
Office	128.89	221.17
Shops	141.57	1,433.23
Stables		6.00
Shaft House	4,249.21	174.91
Engine House	337.51	1,081.51
Dry House	756.74	1,509.26
Warehouse	22.65	
Miscellaneous	<u>557.49</u>	<u>85.29</u>
Total	6,194.06	4,564.87

It will be noted that 2/3 of the cost were the repairs to the shaft houses. In the spring while working a general inspection of the surface plant, we found that the steel work in the Lloyd Shaft House below the landing floor was in very poor condition. The angles were badly rusted and corroded, the channels under the pockets were in bad shape and even the main "I" beams under the landing house floor were almost entirely eaten away by the corrosive action of the hot water solutions used for thawing out the cars.

During the summer and fall the bottom half of the Lloyd shaft house was rebuilt and repairs started on the Morris Shaft.

The above descriptive matter is inserted here because it was omitted under the general heading of Section 6, Buildings and repairs.

Insurance

Year 1930	110.98	.001
Year 1929	<u>113.75</u>	<u>.001</u>
Decrease	2.77	

Nominal change in the two years.

Mining Engineering

Year 1930	4,074.24	.009
Year 1929-	<u>3,440.96</u>	<u>.008</u>
Increase	633.28	.001

The items making up this charge are fixed in the Ishpeming Office and because of changes in making up the cost sheets it is not possible to make the proper comparisons between the two years. We actually had less engineering supervision in 1930 than in 1929, but more work was done in the Ishpeming Office making stockpile and depletion estimates.

MORRIS LLOYD MINEANNUAL REPORTYEAR 19308. COST OF OPERATINGDetailed Cost ComparisonMechanical and Electrical Engineering

	Amount	Cost Per Ton
Year 1930	1,328.07	.003

This is a new account set up on the 1930 cost sheet and this cost was formerly included under central office expense.

Analysis and Grading

Year 1930	12,831.80	.028
Year 1929	<u>11,348.24</u>	<u>.026</u>
Increase	1,483.56	.002

Cost for 1930 includes a portion of the shipping department expense.

A detail of the costs of operating the Morris-Lloyd Mine laboratory for the past two years follows:-

	1930	1929
Number of Determinations	35,215	41,858
Chemists	7,364.80	6,984.00
Other Labor	136.53	341.41
Repairs to Buildings	191.64	75.60
Repairs to Apparatus	257.53	523.51
Chemicals, Etc.,	881.87	1,186.39
Electric Power	296.55	405.36
Water Head & Light	1,315.98	1,196.31
Printing & Stationary	74.79	66.70
Personal Injury	24.00	39.60
Total	<u>10,543.69</u>	<u>10,818.88</u>

It will be noted that the expense of operating the laboratory decreased because of the fewer determinations made on account of the slowing up of shipments, but the account shows an increase which is due to charging the Morris-Lloyd Mine \$2,209.67, as our proportion of the shipping department expense.

Personal Injury

Year 1930	16,340.19	.035
Year 1929	<u>7,377.87</u>	<u>.017</u>
Increase	8,962.32	.018

The increase is largely due to a change in the make up of the cost sheet. This account now includes a portion of the Sociological department expense and a portion of the deficit incurred in operating the Ishpeming Hospital is also charged to it. These two items were \$989.09 and \$7,533.00 respectively for 1930 making a total of \$8,522.09, or an amount of almost equal to the increase.

Safety Department

Year 1930	1,332.28	.003
Year 1929	<u>1,045.60</u>	<u>.003</u>
Increase	286.68	

In 1929 the major portion of the safety department expense was the purchase of knives and gold buttons as a reward to the men for the excellent safety record. In 1930 however, \$1,181.68 out of the total was a proportion of the cost of the safety inspectors department. The balance was mostly first aid supplies.

MORRIS LLOYD MINEANNUAL REPORTYEAR 19308. COST OF OPERATINGDetailed Cost ComparisonTelephones and Safety Devices

	Amount	Cost Per Ton
Year 1930	3,389.38	.007
Year 1929	<u>1,858.71</u>	<u>.004</u>
Increase	1,530.67	.003

Cost for 1929 was below normal. In 1929 expenses totalled \$2,624.23. In 1930 a number of flood lights were purchased for use both underground and surface. These were placed on all the main transfer sub levels under the sub level stopes. On surface the lighting at the loading pockets was improved to make this operation safer for the employees.

Local and General Welfare

Year 1930	8,932.48	.019
Year 1929	<u>3,202.05</u>	<u>.007</u>
Increase	5,730.43	.012

The cost for 1929 was largely North Lake Club House operation and maintenance together with special aid for indigents in the location. In 1930 there was added to this account a proportion of the Ishpeming Y.M.C.A. expense and a proportion of the Sociological Department Expense. This latter item alone amounted to \$4,632.48, for the year 1930. This expense was formerly charged to the Central Office account.

Special Expense

Year 1930	11,978.58	.026
Year 1929	<u>615.05</u>	<u>.001</u>
Increase	11,363.53	.025

The Special Expense account in 1930 included legal Department Costs, Pensions, Donations and Special Allowances. Pensions alone footed up to \$10,111.31, for 1930. The legal expense was \$1,401.38.

Ishpeming Office

Year 1930	16,737.46	.036
Year 1929	<u>32,868.05</u>	<u>.075</u>
Decrease	16,130.59	.039

Decreased because a portion of the Central Office Expense in 1930 was subdivided and charged to general surface expense (chief of police) safety dep't, (Connibears Office) analysis and grading (shipping department) personal injury, (Compensation department) exploring, (geological department) general welfare, (sociological department), etc.,

Mine Office

Year 1930	13,335.58	.028
Year 1929	<u>15,947.75</u>	<u>.037</u>
Decrease	2,612.17	.009

Decreased because of smaller payroll for office force. A portion of the Superintendent's salary was charged to the Cliffs Shaft Mine in 1930.

MORRIS LLOYD MINEANNUAL REPORTYEAR 19309. EXPLORATIONS AND FUTURE EXPLORATIONS

Diamond drill was started in January 1930 and holes No. 102, 103 and 104, were drilled on the 8th level on the 1700, 1900 and 2100 west coordinate lines crosscutting the formation between the main footwall drift and main dike along the south side of the main deposit.

Hole No. 102 cut a great deal of lean or second class ore and 15 feet of high grade ore from 235 to 250 feet in depth from the collar.

Hole No. 103 cut several runs of high grade ore, the best being from 345 to 425 or 80 feet of ore averaging 61.21 Iron .049 Phos.

Hole No. 104 also cut 4 separate lenses of high grade ore the best being from 220 to 280 feet or 60 feet of ore averaging about 62.00 Iron and .050 Phos.

Hole No. 105 drilled on the minus 90 foot sub level did not find any ore.

Hole No. 106 drilled from the East end of the 6th level Morris Mine drift in the Section Six territory also found 90 feet of high grade ore which we think is a part of the downward extension of the main 4th level ore body 400 feet higher up.

We are planning in 1931 to thoroughly explore by drilling the ore body that lies south of the main 6th level drift and 5 diamond drill stations have been cut 200 feet apart along the south side of the main footwall drift.

In the Morris Mine on the 8th level, it is planned to drill three more holes parallel to No. 104 at 200 feet intervals farther west to explore the territory south of the main footwall drift.

10. TAXES

The following table shows tax data for Ely and Ishpeming Townships. It so happens that all of the Lloyd Mine and Section 6 property are in Ishpeming Township, while all the Morris Mine workings are in Ely Townships. Portions of the Stockpiles between the Morris and Lloyd Shafts are in both townships.

<u>Lloyd Mine & Section Six</u>	1930		1929	
	Valuation	Amount	Valuation	Amount
Realty	516,100	19,111.79	301,100	11,075.74
Personal	485,000	17,960.93	600,000	22,086.54
Total	1,001,100	37,072.72	901,100	33,162.28
Collection Fees		370.73		331.62
Total Lloyd & Sec. 6		37,443.45		33,493.90
<u>Morris Mine</u>				
Realty	480,600	17,305.94	301,600	11,952.60
Personal	275,000	9,902.44	324,000	12,840.28
Total	755,600	27,208.38	625,600	24,792.88
Collection Fees		272.09		247.93
Total Taxes		27,480.47		25,040.81
Grand Total	1,756,700	64,923.92	1,526,700	58,534.71
Product Tons		465,371		435,430
Taxes Per Ton of Production		.1395		.1348
Shipment Tons		299,791		629,388
Taxes Per Ton Shipped		.2166		.0922

MORRIS LLOYD MINEANNUAL REPORTYEAR 193010. TAXESTaxes Raised in Ely Township

Tax	1930	1929	1928
State	7,997.50	6,523.15	4,524.57
County	16,729.49	11,528.27	8,915.79
County Road	5,871.89	4,940.50	4,505.74
Highway Improvement	8,000.00	8,000.00	5,000.00
Road Repair	7,000.00	7,000.00	6,000.00
School	13,000.00	13,000.00	13,000.00
One Mill	2,136.68	1,711.77	1,638.22
Bridge	3,000.00	3,000.00	3,000.00
School Buildings	8,000.00	8,000.00	8,000.00
Township Contingent	4,000.00	4,000.00	3,000.00
Rejected Tax	40.38	39.95	
Special Tax	1,200.00		
Total Tax	76,975.94	67,743.64	57,636.55
Tax Paid by Mining Dep't.	27,865.85		
Tax Paid by C.P.&L. Co.	225.48		
Tax Paid by Land Department	979.36		
Total Tax Paid By C.C.I.Co.	29,070.69	27,086.32	26,818.13
Percentage of Tax Paid by C.C.I.Co.	37.76	39.62	46.53
Assessed Valuation	2,136,685.00	1,711,775.00	1,638,220.00
Tax Rate	3.602	3.957	3.519

Taxes Raised in Ishpeming Township

Tax	1930	1929	1928
State	5,276.77	4,999.05	3,259.46
County	11,038.16	8,834.75	6,422.87
County Road	3,874.29	3,786.18	3,425.90
Township Contingent	3,000.00	2,500.00	2,500.00
Highway Improvement	2,000.00	3,000.00	5,000.00
Road Repair	6,500.00	5,000.00	4,000.00
School Tax	18,590.18	18,687.62	18,820.00
One Mill Tax	1,409.82	1,312.38	1,180.16
Rejected Tax	17.64	163.31	2.54
Bridge Tax	500.00		
Total Tax	52,206.86	48,283.29	44,430.93
Tax Paid by Mining Dep't.	39,496.99		
Tax Paid by C.P.&L. Co.	1,210.53		
Tax Paid by Land Dept.	1,382.33		
Total Tax Paid By C.C.I.Co.	42,089.85	38,170.70	33,698.97
Percentage of Tax Paid by C.C.I.Co.	80.62	78.30	75.84
Assessed Valuation	1,409,825.00	1,312,380.00	1,180,160.00
Tax Rate	3.704	3.679	3.764

MORRIS LLOYD MINEANNUAL REPORTYEAR 193011. ACCIDENTS AND PERSONAL INJURYThe accidents for the year follow:

	1930	1929
No. Lost Time	70	46
Compensible Accidents	8	2
Fatal Accident	<u>1</u>	<u>1</u>
Total	<u>79</u>	<u>49</u>

The record for the year was not as good as for the previous year. There is no question but what there is a big chance for improvement, because practically all of the compensable accidents were classified as preventable.

Oscar Peterson, pocketman was killed on October 17th, when a plank thrown from the top landing, hit him on the head. The accident was the result of carelessness on the part of one of the top landers.

13. EQUIPMENTA. Tugger Hoists

The tendency during the year was towards heavier and stronger equipment. Several 25 H.P. Hoists and the large 48 inch Hoe Type Scrapers were used.

We also purchased three new Ingersoll-Rand Scraping units and after minor adjustments were made, we found them to work perfectly.

B. Nordberg - Butler Shovel

In order to replace the old Armstrong loaders which had been in service here for 8 or 10 years it was at first decided to purchase another unit of the same type. The Nordberg Company of Milwaukee, however, had discontinued manufacturing the Armstrong "Shovel" and they sent a "Butler" to us for trial. After a six weeks trial, we decided to purchase the machine. Although it does not complete a cycle as fast as the Armstrong it carries a 7.5 Cu. Ft. dipper compared with 4.5 on the Armstrong. The latter will only load into a two ton car, but the Butler will easily load a 4 ton car. The time saved in switching cars more than compensates for the slower loading.

A careful analysis of the time spent and costs per foot proved to us that it was better to use a mechanical loader in a drift than a scraper slide.

C. Underground Motor Cars:

Twenty new 65 Cu. Ft. Rocker Dump Cars were purchased from the Lake Shore Engine Works. These cars have materially decreased the cost of keeping the levels clean, as was shown previously in this report by the decrease in Trimming Expense.

14. MAINTENANCE AND REPAIRS

- A. We have already mentioned in this report complete details relative to repairing the Shaft Houses.

16. WATER SUPPLY

In the middle of the summer we found, much to our surprise, that the water supply for the location was contaminated by Colon Bacilli. Previous tests for the past five years always showed the water to be potable and safe, and as we have made no changes it was a decided shock to find we had been furnishing the location and mine buildings with unsafe water.

A chlorinating apparatus was immediately telegraphed for from the Wallace-Tiernan Company. This was shipped and set up in four days and the water supply heavily dosed with chlorine for a week to 10 days by using an excess of chlorine up to 0.5 of one percent. Later the excess was put to 0.2. The water since then has been O.K.

MORRIS LLOYD MINEANNUAL REPORTYEAR 193017. CONDITION OF PREMISES

The painting of the houses in the location started in 1929 was continued in 1930. All but a few one story cottages have been finished. All the Company dwellings have been filled all year with only one or two exceptions.

18. NATIONALITY REPORT

Finnish	97
French	62
English	34
Italian	36
Scandinavians	30
Irish	2
Greek	1
Hollander	<u>1</u>
Total	263

TILDEN MINE
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1. GENERAL

The operation at the Tilden Pit during the season of 1930 was very satisfactory. All of the equipment was given a thorough overhauling and changes made to the Crushing Plant and Cars. This work together with the experience gained during 1929 changed the entire operation from one of continual trouble to a smoothly running property.

We found the neck of the bottle was the breaking the ore well and in large enough quantities so that the shovels had good loading at all times. We loaded as much in one 9 hour shift this year as we did on our best days working 23 hours. On this basis we estimate our Crushing Plant to have a capacity of 750,000 tons which would permit of a shut down of from 10 days to 2 weeks to put in new concaves in the large crusher.

The pit operations were intermittent from June on as the furnaces were not anxious to take the ore forward. This increased the cost of production materially as we were shut down for a week or more at a time and had to take care of our skilled labor, such as the Shovel and Locomotive Engineers. The pit operations were put on a five day week basis the 21st of July but on account of the intermittent loading only affected a very few men.

2. PRODUCTION,
SHIPMENTS &
INVENTORIES

a. Production by Grades

Tilden Silica	287,043 Tons
---------------	--------------

This production compares with 441,769 tons produced during 1929, a decrease of 154,726 tons.

b. Shipments

The shipments from the Tilden Mine for 1930 were the same as the production figures, as all the ore mined was forwarded to Lake Erie ports or other points.

c. Stockpile Inventories

There is no ore in stock. We estimate approximately 150,000 tons of broken ore in the pit from the blast made November 1st, after pit operations were completed.

TILDEN MINE
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YEAR 1930

2. PRODUCTION
SHIPMENTS &
INVENTORIES

e. Product by Months

<u>Months</u>	<u>Days Operated</u>	<u>Average Daily Tonnage</u>	<u>Total Tons</u>
April	7	1,081	7,569
May	26	2,020	52,533
June	15	2,711	40,675
July	25	2,627	65,691
August	18	2,408	43,353
September	15	2,400	36,003
October	19	2,162	41,080
November			139
Total	125	2,296	287,043

The first ore of the season was loaded on April 23rd, when the Crushing Plant was put into operation and the No. 31 Shovel loaded the ore. Due to changes made in our cars and installation of a new dumping arrangement at the Crusher, adjustments were necessary, which only permitted the loading of seven railroad cars the first day. This condition was soon over come and our average daily tonnage was between 2,500 and 2,700 tons per 9 hour shift, compared with the best months of 1929 when we loaded about 3,100 tons in 2 shifts of 23 hours.

f. Ore Statement

	<u>Year Tons</u>	<u>Last Year Tons</u>	<u>Increase</u>	<u>Decrease</u>
On hand Jan.1,1930	None	None		
Output for Year	287,043	441,769		154,726
Total	287,043	441,769		154,726
Shipments	287,043	441,769		154,726
Balance on Hand	None	None		

1930. 1-9 Hour Shift 6 days per week April 23 to July 21, 1930
1-9 Hour Shift 5 days per week July 21 to Oct. 31, 1930

1929. 1-9 Hour Shift 6 days per week April 20 to April 30,1929
2-9 Hour Shift 6 days per week May 1st to Aug. 19, 1929
2-11 Hour Shift 6 days per week Aug. 19 to Nov. 6th, 1929

g. Delays

The mechanical and electrical delays during the past season were not very serious and only of a short duration. Our explanation for this is that our shovels were in better shape and the ore was broken, so as to reduce the heavy service on all the equipment. The total delays for the season amounted to 31-1/4 hours with a loss of tonnage of 5,810 tons, compared with 494-1/4 hours delay and loss of 65,025 tons during the season of 1929. A detail of the delays follows:

TILDEN MINE
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YEAR 1930

2. PRODUCTION
SHIPMENTS &
INVENTORIES
(Continued)

g. Delays (continued)

<u>Month</u>	<u>Duration</u>	<u>Delays</u> <u>Tons Lost</u>	<u>Cause</u>
June	1/2 hour	150	Lug broke on Dump Car.
July	5 3/4 Hours 2 Hours		Ram on No.31 Shovel broke and Propelling chain on No.29 shovel Broken pinion on one of small crushers July 28, causing slow crushing for balance of month with only one small crusher in operation.
Total	<u>7 3/4 Hours</u>	2,150	
August	7 1/2 Hours 2 Hours 3 1/2 Hours 1 Hour		No.31 shovel.Trouble with motor generator set; Broken wire on boom motor; Broken bail; putting on new hoisting cable; broken bolt on Boom motor bed. No. 29 shovel. Putting on new hoisting rope; broken latch Blasting in front of No.31 shovel. O re caved on loading track.
Total	<u>14 Hours</u>	1,865	
Sept.,	1 Hour 1/2 Hour 1 1/2 Hours 1 1/2 Hours		No. 29 shovel, replacing latch plate No. 31 shove. Repairs to air hose to boom. Babbit on inside of eccentric on small crusher burnt out. Car off track.
Total	<u>4 1/2 Hours</u>	1,025	
Oct.,	2 Hours 1 Hour 1 1/4 Hours		No. 29 shove. Broken trip cable. Both shovels, burnt out cable from pole to junction box. Carr off track at No.29 shovel.
Total	<u>4 1/2 Hours</u>	620	

Grand Total 1930 - 31 1/4 hours, 5,810 tons

Grand Total 1929 -494 1/4 hours, 65,025 tons

h. Delays From Lack of Current

<u>Month</u>	<u>Duration</u>	<u>Tons Lost</u>	<u>Cause</u>
June	1/2 hour	150	No current, electrical storm.
July	1 hour	250	No current. Trouble on line
Total	<u>1 1/2 hours</u>	400	

TILDEN MINE
ANNUAL REPORT
YEAR 1930

3. ANALYSISa. Average Mine Analysis on Output

<u>Grade</u>	<u>Iron</u>	<u>Phos.</u>	<u>Sil.</u>	<u>Mang.</u>	<u>Alum.</u>	<u>Lime</u>	<u>Mag.</u>	<u>Sul.</u>	<u>Loss by Ignition</u>
Tilden Silica	40.35	.050	40.30	.070	.96	.35	.29	.012	.40

b. Average Analysis on Straight Cargoes

<u>Grade</u>	<u>Iron</u>	<u>Phos.</u>	<u>Mine Sil.</u>	<u>Lake Erie Iron</u>	<u>Moist.</u>
Tilden Silica	40.44	.047	40.61	40.83	2.03

4. ESTIMATE
OF ORE
RESERVESa. Developed Ore1. West Pit

Assumption: 14 cu. ft. equals one ton.
10% deduction for rock.
All ore is Tilden Silica grade.

Ore in sight January 1, 1930, Upper Bench	-	1,118,231 tons
Mined during 1930 from Upper Bench	-	287,043 tons
Ore in sight January 1, 1931, Upper Bench	-	831,188 tons
Ore in sight January 1, 1931, Lower Bench	-	1,870,000 tons
 Total developed ore January 1, 1931, West Pit		 2,701,188 tons

2. East Pit

Assumption: 14 cu. ft. equals one ton.
10% deduction for rock.
Grade: Tilden Silica
All tonnage above 1500' elevation
(Track grade from Crushing Plant)

Ore in sight January 1, 1931, Silicious grade above .015 phos.	-	2,057,143 tons
Ore in sight January, 1, 1931, Silicious grade below .015 phos.	-	3,477,857 tons
 Total developed ore January 1, 1931, East Pit		 5,535,000 tons
 Total developed ore January 1, 1931, East and West Pits		 8,236,188 tons

b. Prospective Ore:

In addition to the developed ore there is probably a much larger tonnage of ore to the North and East of the area developed by the East Pit drilling. The drilling to the North of the West pit has proven a heavy overburden and a dike that would be too expensive to handle in order to mine this grade of ore.

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YEAR 1930

4. ESTIMATE
OF ORE
RESERVES
(Continued)

e. Estimated Analysis

1. West Pit

	<u>Iron</u>	<u>Phos.</u>	<u>Sil.</u>	<u>Mang.</u>	<u>Alum.</u>	<u>Lime</u>	<u>Mag.</u>	<u>Sul.</u>	<u>Ign.</u>	<u>Moist.</u>
Dried	42.50	.045	35.10	.120	.67	.48	.31	.014	.90	
Natural	41.44	.045	34.22	.118	.65	.47	.30	.013	.88	2.50

2. East Pit

Dried	38.20	.017	42.12	.120	.67	.48	.31	.014	.90	
Natural	37.24	.017	41.07	.118	.65	.47	.30	.013	.88	2.50

Of the tonnage estimated for the East Pit, the low phosphorus tonnage will average under .015 and the high phosphorus material .022.

f. Estimate of Production

The following is the estimate of tonnage and analysis of the ore to be produced from the Tilden Mine during 1931.

<u>Grade</u>	<u>Tonnage</u>	<u>Iron</u>	<u>Phos.</u>	<u>Sil.</u>	<u>Sul.</u>	<u>Moist.</u>	<u>Iron Natural</u>
Tilden Silica	250,000	39.00	.040	41.00	.009	2.50	38.02
Tilden Low Phos.	50,000	37.00	.015	44.00	.009	2.50	36.07

5. LABOR &
WAGES

a. Comments

1. Labor

We did not employ as large a crew the past season as we did during 1929 when operating double and completing a number of construction jobs. There was plenty of labor available and our crew was made up of our steady crew and men employed at the pit the previous year. After completing our season's shipments on October 31st, we laid off all the common labor, retaining the churn drill runners, shovel and locomotive engineers and shop men, a total of about 35. These men are not worked full time. The six churn drills are operated six days a week but the crews only work three weeks a month, which takes care of 18 men, the other 17 men work four and five days a week depending on the man and occupation.

2. New Construction

All new construction work was done by our regular mine labor and charged to the proper E&A account.

TILDEN MINE
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YEAR 1930

5. LABOR &
WAGES
(Continued)

b. Comparative State of Wages & Product

	<u>1930</u>	<u>1929</u>	<u>Increase</u>	<u>Decrease</u>
Product	287,043	441,769		154,726
Number of Shifts & Hours	1-9	2-9		1
Average Number of men working	24	72		48
Average Wages per Day	4.70	4.68	.02	
Tons per Man per Day	53.79	33.71	20.08	
Labor Cost per ton Labor Statement	.087	.139		.052
Labor Cost per Ton Cost Sheet	.100	.152		.052
Total Number of Days	5,336	13,102½		7,766½
Amount paid for Labor per Labor Statement	25,118.68	61,439.38		36,320.70
Amount Paid for Labor per Cost Sheet	28,849.65	64,070.43		35,220.78

7. OPEN PIT
OPERATIONS

a. Stripping

Stripping operations were started at the west end of the pit on May 20th and continued until August 1st when all the material that could be washed to the South across the railroad tracks was moved. The ledge at this end of the pit dips abruptly to the Southwest and the surface was as much as 15 feet in places. Besides being covered with heavy roots, there was a large amount of boulders. These boulders had to be moved by team after the sand and gravel was washed away. Due to these unfavorable conditions, the cost was high.

Toward the end of July, washing along the north edge of the pit was started, forcing the material into the swamp to the North. On account of the dry season the swamp absorbed a large quantity of water and very little found its way back to the dam. For this reason stripping was stopped the end of July. Diamond drilling in the swamp was most discouraging as it showed a surface 46 feet deep along the West side and a very thick dike. With this condition existing, it will be many years before we will do any mining North of the original limits of this West Pit.

The clearing of the East Pit area was started during the summer, using any excess labor from the operation of the West Pit. The timber was cut and stumps blasted within the area to be stripped the first season. A 50 Horsepower scraper hoist was set up in September at the bottom of the hill and has made good headway removing the top rough material. We also used the tractor and rotary scraper for short hauls on this stripping operation. We began washing early in October and cleaned off an area from Diamond Drill Hole No. 18 to the West at the track grade. This gave a large enough area so that churn drilling for blast holes could be put down during the winter. The surface material is very coarse and has hard

TILDEN MINE
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YEAR 1930

7. OPEN PIT
OPERATIONS
(Continued)

a. Stripping (Continued)

pan seams on top of the ledge that must be blasted. The hydraulicing cost has been very high on account of the character of the material but the stripping done with the scraper has been most satisfactory and reduced the cost per yard appreciably.

The yardage stripped by months from the West Pit was as follows:

<u>Month</u>	<u>Yards</u> <u>Washing</u>
May	480
June	1,120
July	1,260
Total	<u>2,860</u>

The yardage stripped by months from the East Pit was as follows:

<u>Month</u>	<u>Yards</u> <u>Washing</u>	<u>Yards</u> <u>Scraper</u>	<u>Total</u> <u>Yards</u>
September		700	700
October	500	2,000	2,500
November		2,440	2,440
December		1,290	1,290
Total	<u>500</u>	<u>6,430</u>	<u>6,930</u>

Statement of Stripping Cost West Pit

	<u>1927-28</u>	<u>1929</u>	<u>1930</u>	<u>Total</u>
Cubic Yards Stripped	23,000	13,365	2,860	39,225
Holmes Mine	\$ 53.53			\$ 53.53
General Storehouse	68.60			68.60
Cliffs Shaft Mine	510.85			510.85
Ogden Mine	1,197.40			1,197.40
Labor at Mine	7,455.47	5,600.20	1,627.15	14,682.82
Supplies at Mine	6,535.24	4,222.15	1,136.43	11,893.82
Total	<u>\$ 15,821.09</u>	<u>\$ 9,822.35</u>	<u>\$ 2,763.58</u>	<u>\$ 28,407.02</u>
Cost per Cubic Yard	.688	.742	.966	.724

Statement of Stripping Cost East Pit

	<u>1930</u>
Cubic Yards Stripped	6,930
Labor at Mine	\$ 3,047.87
Supplies at Mine	2,084.38
Total	<u>5,132.25</u>
Cost per Yard	.740

TILDEN MINE
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YEAR 1930

7. OPEN PIT
OPERATIONS
(Continued)

e. Open Pit Operations

The first ore for the season was loaded on April 23rd, when the Crushing Plant was put into operation. We only loaded ore with the No. 31 Shovel until the 29th of the month by which time the No. 29 Shovel had worked itself westward casting the broken ore from along the toe of the bank until it reached a full face of broken ore along a loading track which had been laid from a point opposite the center of the pit. The ore loaded between April 23rd and May 13th was left in the pit from the previous year.

The holes drilled during the winter 1929-30 were blasted on May 13th, breaking better than 250,000 tons, which filled our season's requirements. The No. 31 shovel started from the East end of the pit and cast the ore to the North until it had advanced far enough eastward so both shovels could load trains on the same loading track. As soon as the first cut was loaded out, the No. 31 started the second cut working from the West end of the pit, while the No. 29 shovel worked from the East end. The main pit track was extended to the West by blasting off from the hill side so that a switch to the inside loading track could be installed. This track arrangement allowed the empty trains to come in on the main track to the West end of the pit and then switch back onto the inside loading track. The loaded train would then go direct to the crusher. If the train being loaded by the No. 29 shovel was loaded and ready to go to the crusher then the one at No. 31 shovel would move up to No. 29 and the empty train to No. 31. The loading was watched so as to cause as little congestion at the crusher as possible.

During the winter we rebuilt the pit cars by making one side vertical and extending the lip on the opposite side. This allowed the loading of the cars to their capacity with very little spillage and as a result we were able to do away with one less man at the shovel whose duty it had been to remove chunks that dropped off the cars and rolled under the wheels. Further, the pit bottom was kept in better shape for shifting of tracks.

Two second hand 45 ton locomotives were purchased from the Oliver Iron Mining Company and with the No. 4 locomotive purchased last summer from the Biwabic Mining Company our motive power was much improved. These locomotives were able to handle a train of 4 cars over heavy grades without any difficulty.

The construction of a coal dock and loading pocket cut down the delay experienced during 1929 due to coaling the locomotives by hand. A large water tank was also installed which will cut down the time of taking water. General operating conditions were greatly improved over 1929 which is shown by the average daily production on a 9 hour shift in 1930 compared with that secured working 23 hours in 1929.

TILDEN MINE
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YEAR 1930

7. OPEN PIT
OPERATIONS
(Continued)

e. Open Pit Operation (Continued)

It proved quite an advantage to break a large tonnage at one time, as it reduced the number of periods when cleaning the last part of a blast along the toe of the pit face, which is slow loading and also the time lost taking up tracks and relaying after each blast - followed by a small daily tonnage for a few shifts until the shovels could work into a good bank of ore.

f. Drilling, Blasting and Explosives

Our churn drilling for blast holes has been more or less continuous since the pit started operating in April, 1929. On October 21st, 1929 we had sufficient holes drilled for our 1929 tonnage. We continued to operate the five drills on a double shift for the 1930 tonnage. The cost of this work was carried in a deferred account and charged to the ore mined in 1930 on a tonnage basis. On January 6th, our drilling program of two rows of holes across the entire length of the pit face had progressed so well that the drills were put on a single shift. By March 22nd, the required number of holes were completed. These holes were blasted on May 13th and drilling resumed May 19th for additional ore.

The first row of holes was drilled 20 feet back of the toe of the cut and 15 feet apart in a horizontal direction. The second row was drilled 15 feet back of the first and staggered so as to come in between the holes in the first row. On account of the character of the ore we were not sure that the results from blasting a double row of holes would be satisfactory. The loading was carefully planned and the ore broke well, even along the toe, where previously there had been difficulty. This was due to drilling the holes further below grade and loading the bottom of the holes with 90% powder.

The drilling done from May 19th to October 16th completed one row along 750 feet of the pit face and several rows for the West 150 feet. The reason for the field blast at the west end of the pit was on account of a dike 15 to 25 feet thick along this 150 feet. By blasting this dike in a field blast, it is held in place and is easily separated when loading.

Four drills were operated from May 19th to June 2nd when a No. 29 all steel Armstrong drill was put into operation for a thirty day trial. This trial proved very satisfactory and it was purchased. During the trial it showed an increase in footage drilled over the best of the four Cyclone drills of 20.56%. In addition this machine drills without jars and uses a wire line cable instead of a manila rope at about one third the cost. The cost of these two items in our winter drilling was

TIDDEN MINE
ANNUAL REPORT
YEAR 1930

7. OPEN PIT
OPERATIONS
(Continued)

f. Drilling, Blasting & Explosives (Continued)

\$.072 and \$.061 per foot respectively. The machine does not drill any faster than the Cyclone drills but does not take as much time to move and set up over a new hole. It has very little delay on account of stuck tools and if the bit or stem breaks off in the hole it is easily recovered.

The blast made in May broke enough ore for our season's requirements but the holes drilled during the summer were blasted on November 1st so as to give employment to some of our men during the winter. Our program is to drill two rows of holes across the entire face of the pit. This drilling will be completed by the time the shipping season opens and the drill crews will be used in the pit and Crushing Plant until the next blast is made.

Statement of Holes Drilled West Pit

<u>Month</u>	<u>H O L E S</u>			<u>F E E T</u>		
	<u>Number Drilled</u>	<u>Number Lost</u>	<u>Total</u>	<u>Drilled</u>	<u>Lost</u>	<u>Total</u>
January	24	1	23	2,082	63	2,019
February	22	1	21	1,810	31	1,779
March	16	-	16	989	-	989
April	-	-	-	-	-	-
May	9	1	8	793	54	739
June	25	1	24	2,160	50	2,110
July	21	1	20	1,681	158	1,523
August	19	1	18	1,454	51	1,403
September	15	-	15	1,164	-	1,164
October	9	-	9	628	-	628
November	16	-	16	1,514	182	1,332
December	20	-	20	1,890	-	1,890
Total	196	6	190	16,165	589	15,576

The above table shows the drilling done during the year 1930. On March 22nd we had sufficient holes drilled for our 1930 tonnage. The cost of drilling from May 19th, 1930 to the end of the year is being carried in a deferred account and will be charged to the ore mined in 1931.

Statement of Holes Drilled East Pit

<u>Month</u>	<u>H O L E S</u>			<u>F E E T</u>		
	<u>Number Drilled</u>	<u>Number Lost</u>	<u>Total</u>	<u>Drilled</u>	<u>Lost</u>	<u>Total</u>
November	5	-	5	255	-	255
December	10	-	10	461	-	461
Total	15	-	15	716	-	716

TILDEN MINE
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YEAR 1930

7. OPEN PIT
OPERATIONS
(Continued)

f. Drilling, Blasting & Explosives (Continued)

Recap of Holes Drilled West and East Pits

Pit	H O L E S			F E E T		
	Number Drilled	Number Lost	Total	Drilled	Lost	Total
West	196	6	190	16,165	589	15,576
East	15		15	716		716
Total	211	6	205	16,881	589	16,292

Division of Drilling Between 1930 and 1931 Ore

1930 Ore	131½.	3	128½	11,045	94	10,951
1931 Ore (Tilden)	134	4	130	11,284	495	10,789
1931 Ore (East Tilden)	15	-	15	716	-	716

Statement of Drilling for 1930 Tonnage

1929	69½	1	68½	6,164		6,164
1930	62	2	60	4,881	94	4,787
Total	131½	3	128½	11,045	94	10,951

Two blasts were made during 1930, one on May 13th and one on November 1st. All of the ore broken by the blast of May 13th was loaded out, while that broken on November 1st is for the season 1931 and was only blasted in order to continue drilling through the winter.

In making the blasts of May 13th and November 1st the following powder and fuse were consumed:

	Blast of <u>May 13th</u>	Blast of <u>Nov. 1st.</u>
Cordeau-Bickford fuse	13,000 ft.	10,139 ft.
40% Hercules Powder	1,454 lbs.	
60% Hercules Powder	6,900 lbs.	
40% Gelatin		800 lbs.
60% Gelatin	300 lbs.	5,200 lbs.
80% Gelatin	32,000 lbs.	20,550 lbs.
90% Gelatin	2,500 lbs.	2,550 lbs.
Gelamite No. 2	37,500 lbs.	19,800 lbs.
Total Powder	86,650 lbs.	48,900 lbs.
Estimated tons broken	250,000 tons	150,000 tons

TILDEN MINE
ANNUAL REPORT
YEAR 1930

7. OPEN PIT
OPERATIONS
(Continued)

f. Drilling, Blasting & Explosives (Continued)

Statement of Blasts Made in 1930

Blast No.	Date	Section of Pit	No. Holes	Total Depth	Pounds Powder	Estimated	Ton per	Ton per
						Tons Broken	foot of hole	pound of powder
1	May 13	Entire face	131	10951	80650	250,000	23	3.10
2	Nov. 1	Entire face	94	7567	48900	150,000	19.82	3.06

The tons broken per pound of powder is very nearly the same in the two blasts. The reason that the tons broken per foot of hole in the November blast is less than that for the May one is due to the field blast made at the west end of the pit.

Statement of Operating Churn Drills for the Year 1930

16,292' of Holes Drilled.

	Labor	Supplies	Total	Cost per Foot
<u>Operating</u>				
Drilling at Mine	10,598.08	4,025.15	14,623.23	.898
Building roads	430.55	617.80	1,048.35	.064
Sharpening Bits	1,204.46	429.72	1,634.18	.100
Pipe & Fittings	202.77	183.29	386.06	.024
Rope		808.42	808.42	.049
Drill Bits		831.63	831.63	.051
Electric Power		715.93	715.93	.044
Truck & Tractor	1,199.21	505.50	1,704.71	.105
Total Operating	13,635.07	8,117.44	21,752.51	1.335
<u>Maintenance</u>				
Drills	597.65	1,750.96	2,348.61	.144
Drill Sharpener	60.91	512.08	572.99	.036
Total Maintenance	658.56	2,263.04	2,921.60	.180

Total Operating &
Maintenance, 1930 \$ 14,293.63 \$ 10,380.48 \$ 24,674.11 1.515

Total Operating &
Maintenance, 1929 - 20,362 ft. \$ 39,000.93 1.905

Cost of Drilling and Blasting

	Primary		Secondary		Total	
	Amount	Per Ton	Amount	Per Ton	Amount	Per Ton
Drilling	\$ 20,457.77	.071	\$ 4,117.12	.015	\$24,574.89	.086
Explosives	13,533.51	.047	1,632.95	.006	15,166.46	.053
Total, 1930	\$ 33,991.28	.118	\$ 5,750.07	.021	\$39,741.35	.139
Total, 1929	\$ 64,154.90	.146	\$ 3,133.10	.008	\$67,288.00	.153

TILDEN MINE
ANNUAL REPORT
YEAR, 1930

7. OPEN PIT
OPERATIONS
(Continued)

f. Drilling, Blasting & Explosives (Continued)

The cost of the primary drilling and blasting shows a decrease in cost of \$.028 while the secondary shows an increase of \$.013. We employed three men during the entire season drilling and blasting the high spots in the pit and along the toe. By the end of the season the pit was in excellent condition. This expense will be reduced materially in 1931.

Statement of Churn Drill Bits Sharpened

<u>Month</u>	<u>No. Churn Drill Bits Sharpened</u>	<u>Feet of Holes Drilled</u>	<u>Feet of Hole Per Bit Used</u>
January	279	2,082	7.46
February	199	1,810	9.07
March	132	989	7.50
April	-	-	-
May	279	793	2.8
June	343	2,160	6.3
July	242	1,681	6.94
August	201	1,454	7.23
September	146	1,164	8.00
October	101	688	4.69
November	265	1,514	5.7
November East Tilden	11	255	23.2
December	439	1,890	4.3
December East Tilden	12	461	38.4
<u>Total</u>	<u>2,649</u>	<u>16,941</u>	<u>6.3</u>
Tilden	2,625	16,225	6.1
East Tilden	23	716	31.1
<u>Total</u>	<u>2,649</u>	<u>16,941</u>	<u>6.3</u>

Early in January we took up with the Armstrong Manufacturing Company, from whom we purchased the bit dressing machine, that our blacksmith was not getting the best results sharpening the churn drill bits. They sent a service man to the Tilden Mine where he spent two weeks with our blacksmith. He was able to improve our conditions and we are now able to forge a good bit and get better results in our drilling. We have discontinued the use of the oil heating furnace and installed one heated by coke. The heating of the bits in the oil furnace heats them too rapidly and draws out the carbon and makes it impossible to secure a hard temper on the cutting edge. We changed the die from a 5-7/8" with a 5° taper, to 6" with an 8° taper. We rearranged the position of the dressing machine with respect to the heating furnace so that the bit can be set in place for sharpening without losing any appreciable amount of heat. Another thing the Armstrong people recommended was that we do not cool the bits completely before heating them to a tempering heat. This saves considerable time and results in a more uniform hardening throughout the steel. Since January our blacksmith has had no trouble in sharpening the bits.

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7. OPEN PIT
OPERATIONS:
(Continued)

f. Drilling, Blasting and Explosives: (Continued)
Distribution of Explosives Used:

<u>PRIMARY BLASTING:</u>				
<u>Kind</u>	<u>Quantity</u>	<u>Average Price</u>	<u>Total 1930</u>	<u>Total 1929</u>
No. 2 Gelamite	37,550	13.25	4975.38	
No. 4 Hercomite				556.91
40% Gelatine	1,450	12.00	174.00	4098.00
60% Gelatine	8,000	14.25	1140.00	5130.00
80% Gelatine	32,000	18.25	5840.30	13623.38
90% Gelatine	2,500	20.75	518.75	
Total Powder	81,500	15.52	12648.43	23408.29
<u>Blasting Supplies:</u>				
Connecting Wire	8	.41	3.28	
No. 6 Caps				46.80
Electric Blasting Caps				6.80
Californian Cap Crimper				22.00
Crescent Fuse				56.16
Eagle Brand Fuse		<u>Per M.</u>		34.65
Dbl. Count. Cord. Bickford Fuse	8,248'	48.875	403.12	1221.15
Single " " " "	3,159'	42.50	134.26	358.11
#2 W.C. Cord. Bickford Safety Fuse	5,065'	68.00	344.42	
Total Fuse, Caps, Etc.			885.08	1745.67
TOTAL ALL EXPLOSIVES FOR PRIMARY BLASTING			13533.51	25153.96
<u>SECONDARY BLASTING:</u>				
60% Gelatine	10,050	14.25	1430.74	1218.37
<u>Blasting Supplies:</u>				
No. 6 Caps	4,550	11.58	52.75	23.44
Crescent Fuse	21,800'	6.24	136.12	37.44
No. 6 Electric Blasting Caps	150	6.10	9.16	
Connecting Wire	10#	.418	4.18	
Total Fuse, Caps, Etc.			202.21	60.88
TOTAL ALL EXPLOSIVES SECONDARY BLASTING			1632.95	1279.25
<u>EXPLORING:</u>				
60% Gelatine	200	14.25	28.50	
No. 6 Electric Blasting Caps	100		5.81	
Connecting Wire	23#	.43	9.90	
TOTAL ALL EXPLOSIVES EXPLORING			44.21	
TOTAL ALL EXPLOSIVES AS PER COST SHEET			15210.67	26433.21

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7. OPEN PIT
OPERATIONS:
(Continued)

f. Explosives, Drilling and Blasting: (Continued)
Statement of Explosives Used:

<u>Kind</u>	<u>Quantity</u>	<u>Average Price</u>	<u>Total 1930</u>	<u>Total 1929</u>
No. 4 Hercomite				556.91
40% Gelatine	1,450	12.00	174.00	4098.00
60% Gelatine	18,250	14.25	2599.24	6348.37
80% Gelatine	32,000	18.25	5840.30	13623.38
90% Gelatine	2,500	20.25	518.75	
No. 2 Gelamite	<u>37,550</u>	<u>13.25</u>	<u>4975.38</u>	
Total Powder	91,750	15.37	14107.67	24626.66
<u>Blasting Supplies:</u>		<u>Per M.</u>		
No. 6 Caps	4,550	11.58	52.75	70.24
Eagle Brand Fuse				34.65
Crescent Fuse	21,800'	6.24	136.12	93.60
Dbl. Count. Cord. Bickford Fuse	8,248'	48.87	403.12	1221.15
Single " " " "	3,159'	42.50	134.26	358.11
#2 W.C. Cord. Bickford Safety Fuse	5,065'	68.00	344.42	
No. 6 Electric Blasting Caps	250	59.88	14.97	6.80
Californian Cap Crimper				22.00
Connecting Wire	41#	.422	<u>17.36</u>	
Total Fuse, Caps, Etc.			1103.00	1806.55
TOTAL ALL EXPLOSIVES AS PER COST SHEET			15210.67	26433.21
PRODUCT			287,043	441,769
Pounds of Powder per Ton of Ore			.032	.035
Cost per Ton for Powder			.049	.055
Cost per Ton for Fuse, Caps, Etc.			.004	.005
Cost per Ton for All Explosives			.053	.060
Average Price per Pound for Powder			.1537	.1561

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8. COST OF
OPERATING:

a. Comparative Mining Costs:

	<u>1930</u>	<u>1929</u>	<u>Increase</u>	<u>Decrease</u>
<u>PRODUCTION:</u>				
Ore Produced	287,043	441,769		154,726
Average Daily Product	2,295	2,482		187
Tons per Man per Day	53.79	33.71	20.08	
No. of Days Operating	125	178		53
No. of Shifts and Hours	1-9	2-9 & 1-9		
Budget Estimated Production	600,000	250,000		350,000
Budget Estimated Cost at Mine	.405	.503		.098
<u>COSTS:</u>				
Pit Operating Accounts	.357	.328	.029	
Pit General Accounts	.055	.039	.016	
Cost at Mine per Cost Sheet	.412	.367	.045	
<u>Depreciation</u>				
Plant and Equipment	.077	.077		
Movable Equipment	.006	.010		.004
Taxes	.074	.015	.059	
Shipping	.016	.016		
Supply Inventory	.000	.000		
Total Cost at Mine	.585	.485	.100	
<u>EXPENSE BEYOND MINE:</u>				
Rail Freight	.640	.640		
Lake Freight	.760	.760		
Cargo, Insurance & Analysis	.010	.010		
Shrinkage	.012	.011	.001	
Total Cost Lower Lake Ports	2.007	1.906	.101	

b. Detailed Cost Comparison:

1. Days and Shifts:

The mine operated on a 1-9 hour shift six days per week from April 23rd to July 21st and then on a 1-9 hour shift five days per week for the balance of the season. Even on this schedule the operation was intermittent on account of the movement of the ore. In 1929 the pit operated 2-9 hour shifts until August and then two 11½ hour shifts six days per week.

2. Production:

The pit was in shape and conditions were right for a large production during the past season. Our daily average for a single shift was almost as large as that secured on a double shift in 1929.

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YEAR 1930.

8. COST OF
OPERATING:
(Continued)

b. Detailed Cost Comparison: (Continued)

3. Cost of Production:

The cost of production of \$.412 per ton compares with \$.367 in 1929. Operating conditions were muchly improved this year and with an equal tonnage would have shown a lower cost. In fact if the Winter Expense of \$.108 per ton were deducted the cost of production would show a decrease of \$.063 instead of an increase of \$.045.

The cost on cars of \$.585 compared with \$.485. A further increase of \$.055 is due to taxes which are \$.059 higher in 1930 than 1929.

4. Open Pit Costs:

Drilling and Blasting:

	<u>Amount</u>	<u>Cost Per Ton</u>
Year 1930	\$ 39,741.35	\$.138
Year 1929	<u>67,288.00</u>	<u>.156</u>
Decrease	\$ 27,546.65	\$.018

This large decrease is due to 154,726 tons less production. The decrease in unit cost is explained by part of the 1930 tonnage being charged out in 1929. The cost of drilling the holes blasted in 1930 did show a lower cost per foot, however.

Electric Shovels Operating:

	<u>Amount</u>	<u>Cost Per Ton</u>
Year 1930	\$ 7,018.72	\$.025
Year 1929	<u>13,166.98</u>	<u>.030</u>
Decrease	\$ 6,148.26	\$.005

The shovels were operated only on a single shift compared with a double shift and much overtime in 1929. The improved operating conditions allowed loading a larger tonnage per shift, resulting in a lower cost per ton.

Electric Shovels Maintenance:

	<u>Amount</u>	<u>Cost Per Ton</u>
Year 1930	\$ 11,707.76	\$.040
Year 1929	<u>18,774.17</u>	<u>.040</u>
Decrease	\$ 7,066.41	\$.000

The actual repairs made during the operating season were small compared to those made in 1929. However, the No. 29 shovel was completely overhauled and the No. 31 gone over at a cost of \$ 9,024.03. The unit cost is the same, as the lower cost for the year was offset by the smaller tonnage.

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8. COST OF
OPERATING:
(Continued)

b. Detailed Cost Comparison: (Continued)

4. Open Pit Costs: "

Locomotives and Cars Operating:

	Cost	
	<u>Amount</u>	<u>Per Ton</u>
Year 1930	\$ 5,267.74	\$.018
Year 1929	<u>12,067.04</u>	<u>.027</u>
Decrease	\$ 6,819.30	\$.009

The operating cost for 1930 was less than half that for 1929. The pit operated less than half as much time in 1930, reducing the labor and supply cost accordingly. The decrease in cost per ton is due to handling a larger average daily tonnage.

Locomotives & Cars, Repairs & Maintenance:

	Cost	
	<u>Amount</u>	<u>Per Ton</u>
Year 1930	\$ 7,706.23	\$.027
Year 1929	<u>1,038.11</u>	<u>.002</u>
Increase	\$ 6,668.12	\$.025

This large increase is explained by the changes made to the cars during the winter and absorbed in the account, amounting to \$ 6966.99. The actual maintenance was less in 1930 than in 1929. The same explanation applies to the increased cost per ton.

Track Expense:

	Cost	
	<u>Amount</u>	<u>Per Ton</u>
Year 1930	\$ 3,619.86	\$.013
Year 1929	<u>4,383.34</u>	<u>.009</u>
Decrease	\$ 763.48	
Increase		\$.004

There was less track work done during the loading season, as only one blast was made for 1930 ore. The 1930 charges include a large amount of permanent work. The main track was relaid and ballasted on the edge of the pit as part of the winter expense and then the track was extended to the west so a switch could be made to the inside loading track.

Water Supply:

	Cost	
	<u>Amount</u>	<u>Per Ton</u>
Year 1930	\$ 377.85	\$.001
Year 1929	<u>88.40</u>	<u>.000</u>
Increase	\$ 289.45	\$.001

The large part of this increase is for work done on the water supply during the winter. In November when the large pump was closed down a new arrangement was made to supply the cooling water for the compressor.

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8. COST OF
OPERATING:
(Continued)

b. Detailed Cost Comparison: (Continued)

4. Open Pit Costs: " "
Crushing and Screening:

	<u>Amount</u>	<u>Cost</u> <u>Per Ton</u>
Year 1930	\$ 19,978.31	\$.070
Year 1929	<u>22,465.22</u>	<u>.050</u>
Decrease	\$ 2,486.91	
Increase		\$.020

The decrease in this account is not proportional to the smaller tonnage handled due to the extensive changes and repairs made to the plant during the winter, amounting to \$ 9,445.88. The increased cost per ton is due to the heavy winter expense charge and small production.

General Open Pit Expense:

	<u>Amount</u>	<u>Cost</u> <u>Per Ton</u>
Year 1930	\$ 3,934.63	\$.014
Year 1929	<u>2,570.52</u>	<u>.006</u>
Increase	\$ 1,364.11	\$.008

A large part of this expense was taken care of in the opening costs in 1929, explaining this increase for 1930. There was more work on roads and general clean up, however, this year.

Open Pit Superintendence:

	<u>Amount</u>	<u>Cost</u> <u>Per Ton</u>
Year 1930	\$ 3,000.00	\$.011
Year 1929	<u>3,234.30</u>	<u>.008</u>
Decrease	\$ 234.30	
Increase		\$.003

All of the Captain's time was charged to operating in 1930, while in 1929 part was distributed to E & A. accounts, and there was a night foreman for six months. The increase in cost per ton is due to the smaller production.

Waste File Expense:

	<u>Amount</u>	<u>Cost</u> <u>Per Ton</u>
Year 1930	\$ 136.75	\$.000
Year 1929		
Increase	\$ 136.75	\$.000

Only a small charge to this account in 1930.

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8. COST OF
OPERATING:
(Continued)

b. Detailed Cost Comparison: (Continued)

5. General Mine Accounts:

Insurance:

		<u>Amount</u>	<u>Cost</u> <u>Per Ton</u>
Year 1930	\$	76.44	\$.000
Year 1929		<u>54.00</u>	<u>.000</u>
Increase	\$	22.44	\$.000

Mining Engineering:

		<u>Amount</u>	<u>Cost</u> <u>Per Ton</u>
Year 1930	\$	1,268.78	\$.004
Year 1929		<u>1,268.86</u>	<u>.003</u>
Decrease	\$.08	
Increase			\$.001

Same charge for each year.

Mechanical & Electrical Engineering:

		<u>Amount</u>	<u>Cost</u> <u>Per Ton</u>
Year 1930	\$	1,691.35	\$.006
Year 1929		<u>326.57</u>	<u>.001</u>
Increase	\$	1,364.78	\$.005

This large charge for 1930 is on account of a new distribution of this expense to the mines. Only a small proportion was charged in 1929.

Analysis and Grading:

		<u>Amount</u>	<u>Cost</u> <u>Per Ton</u>
Year 1930	\$	4,705.78	\$.016
Year 1929		<u>1,423.78</u>	<u>.003</u>
Increase	\$	3,282.00	\$.013

The 1930 charges includes a proportion of the grading department as well as for the laboratory expense.

Personal Injury Expense:

		<u>Amount</u>	<u>Cost</u> <u>Per Ton</u>
Year 1930	\$	1,372.41	\$.005
Year 1929		<u>3,428.31</u>	<u>.008</u>
Decrease	\$	2,055.90	\$.003

This charge 2% of total payroll. Less labor employed during 1930.

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8. COST OF
OPERATING:
(Continued)

b. Detailed Cost Comparison: (Continued)

5. General Mine Accounts: "

<u>Safety Department:</u>		Cost
	<u>Amount</u>	<u>Per Ton</u>
Year 1930	\$ 113.82	\$.000
Year 1929	<u>632.47</u>	<u>.001</u>
Decrease	\$ 518.65	\$.001

The 1929 charge includes Tilden Mine's proportion of the Safety Picnic.

Local and General Welfare:

		Cost
	<u>Amount</u>	<u>Per Ton</u>
Year 1930	\$ 416.00	\$.002
Year 1929	<u>841.34</u>	<u>.002</u>
Decrease	\$ 425.34	\$.000

Smaller proportion charged to Tilden Mine in 1930 on account of decrease in production.

Special Expense, Pensions & Allowances:

		Cost
	<u>Amount</u>	<u>Per Ton</u>
Year 1930	\$ 767.96	\$.003
Year 1929	<u>1,818.16</u>	<u>.004</u>
Decrease	\$ 1,050.20	\$.001

Ishpeming Office:

		Cost
	<u>Amount</u>	<u>Per Ton</u>
Year 1930	\$ 1,113.00	\$.004
Year 1929	<u>3,051.06</u>	<u>.007</u>
Decrease	\$ 1,938.06	\$.003

Mine Office:

		Cost
	<u>Amount</u>	<u>Per Ton</u>
Year 1930	\$ 4,380.12	\$.015
Year 1929	<u>4,312.53</u>	<u>.010</u>
Increase	\$ 67.59	\$.005

Small difference. Increase in cost per ton due to smaller production.

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9. EXPLORATIONS
AND FUTURE
EXPLORATIONS:

1. West Pit:

In the spring after the blast hole drilling was completed two drills were moved into the swamp north of the West Pit, to further test the depth of the surface and also the grade of the material in this area. Four churn drill holes were put down, Nos. 23, 25, 30 and 31. These holes showed the surface material to average about 14 feet. The iron content of the material cut in these holes varied so widely that we were apprehensive that we did not have a tight seal at ledge and some of the surface material was washing into the hole and lowering the iron units. Hole No. 30 struck dike at 107 feet, which is probably the extension of the ore at the northeast corner of the pit.

After the diamond drilling program was finished in July at the East Tilden, one drill was moved to the West Pit. Three diamond drill holes were put down north of the west end of the pit. Hole Nos. 37 and 38 had 46 and 45 feet of surface material and cut dike at 74 and 85 feet respectively. Hole No. 39 was then drilled 300 feet northwest of No. 8 on cross-section "B", just on the north edge of the swamp. This hole was also discouraging, as the material was not of uniform analysis, varying from 40.50% iron to 31.70. The entire depth of 171 feet averaging about 35% iron. Due to the heavy stripping over this swamp area and grade of the underlying material, it is very questionable if the north limit of the West Pit will be changed from its original location used in estimating the tonnage in this pit.

2. East Pit. (Summit Mountain)

The Summit Mountain Deposit is located in the $S\frac{1}{2}$ of the $NE\frac{1}{4}$ of Section 26-47-27, about one half mile east of the Tilden Mine West Pit. A demand for a silicious ore very low in phosphorus by some of the furnaces encouraged us to explore this area. Test pits put down years ago and outcrops of the Summit Mountain Deposit indicated a silicious ore of very low phosphorus content.

Drilling was started on the large outcrop on the south side of Summit Mountain late in 1929. The results of the many churn and diamond drill holes were so varied that the drilling program was about completed before a definite plan of mining could be formulated. Holes Nos. 12 and 13 drilled on the same north-south section (11500 N.) graded alike except in the phosphorus content, No. 12 analyzing .015 and No. 13 .026. No. 14 hole was then drilled 600 feet east of No. 12 and showed 24 feet of surface material with a mixture of ore, jasper and dike below. No. 15, midway between Nos. 12 and 14, proved silicious ore, but with a phosphorus content of .020. The two diamond drills were then moved farther west than the originally planned drill sites and Nos. 16, 17 and 18 holes all proved silicious ore, the major portion of which was below .015 phosphorus. Meanwhile churn drill holes 19, 20, 21, 22, 24 and 26 had shown a mixture of lean silicious ore, jasper and dike along the foot of the hill, indicating that

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9. EXPLORATIONS
AND FUTURE
EXPLORATIONS:
(Continued)

2. East Pit: (Summit Mountain). (Continued)

a railroad cut to reach the ore in Holes 12 and 14 would be expensive on account of large tonnage to be wasted.

The favorable results of Holes 16, 17 and 18 were then developed further by churn drilling this westerly extension. Holes 27, 28, 29, 32, 33 and 34 proved that nothing but siliceous ore need be mined in order to reach the low phosphorus ore in Holes 16, 17 and 18. These later discoveries were especially pleasing because the initial pit to crusher haul of the low phosphorus ore will be less than 1000 feet (about the same as from the West Pit) and a minimum of siliceous ore will have to be mined because of the low banks at the start.

Diamond drill holes Nos. 35 and 36 were drilled south of No. 15 and No. 14 respectively to complete the original program planned for this East Pit. Hole No. 35 averaged .022 phosphorus, but No. 36 was the exceptional hole, averaging only .009 phosphorus, and being the hole most distant from the crusher.

3. E & A. No. 568 - Summit Mountain Explorations:

The expenditure for these explorations was double the estimate. The drilling was very much more difficult than anticipated from the experience at the West Pit. The hill side was very steep and a 60 degree hole kept close to the top of the ledge for quite a distance. The surface cracks in the ledge made it necessary to do considerable cementing in order to get the water back. The ground was very hard and the carbon loss heavy. On account of the variation in grade of material more holes were drilled, exceeding the original footage several hundred feet. In addition to the diamond drilling ten churn drill holes were put down to test the south limit of the proposed East Pit on account of an existing dike. The churn drilling totaled 470 feet.

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10. TAXES:Tilden Township:

<u>Tilden Mine:</u>	<u>1930</u>		<u>1929</u>	
	<u>Valuation</u>	<u>Taxes</u>	<u>Valuation</u>	<u>Taxes</u>
N $\frac{1}{2}$ of NW $\frac{1}{4}$ Sec. 26-47-27	\$ 460,000	\$ 17,609.95	\$ 116,000	\$ 4,672.91
SE $\frac{1}{4}$ of SW $\frac{1}{4}$ Sec. 23-47-27	4,000	153.13	4,000	161.14
Supplies and Equipment	80,000	3,062.60	40,000	1,611.35
Total Tilden	\$ 544,000	\$ 20,825.68	\$ 160,000	\$ 6,445.40

Summit Mountain Mine: (A)

N $\frac{1}{2}$ of NE $\frac{1}{4}$ Sec. 26-47-27 (A)	\$ 1,400	\$ 53.60		
S $\frac{1}{2}$ of NE $\frac{1}{4}$ Sec. 26-47-27 (A)	900	34.46		
Total Summit Mountain Mine	\$ 2,300	\$ 88.06		

Ogden Mine:

Lot 3, Sec. 13-47-27	\$ 150	\$ 5.74	\$ 150	\$ 6.04
Part of Lot 4, Sec. 13-47-27	100	3.83	100	4.03
Lot 5, Sec. 13-47-27	150	5.74	150	6.04
SE $\frac{1}{4}$ of SW $\frac{1}{4}$ Sec. 13-47-27	200	7.66	200	8.06
Total Ogden Mine	\$ 600	\$ 22.97	\$ 600	\$ 24.17

Total Tilden Mine, Summit Mountain Mine and Ogden Mine	\$ 546,900	\$ 20,936.71	\$ 160,600	\$ 6,469.57
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Collection Fees		<u>209.37</u>		<u>64.70</u>
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Grand Total Tilden, Summit Mountain & Ogden		\$ 21,146.08		\$ 6,534.27
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(A) - Transferred from Land Department 1930.

11. PERSONAL
INJURIES:

There were no lost time accidents at the Tilden Mine during the past year compared with four in 1929 and only eight slight ones. We are proud of this record and will make renewed efforts to maintain it during 1931.

12. NEW CONSTRUCTION
AND PROPOSED
NEW CONSTRUCTION:E & A. No. 514 - Opening and Equipping Tilden Mine:

The roundhouse and equipment storage building erected during the fall of 1929 was gunited during the summer. One track has been laid along the south side where the locomotives are spotted for winter repairs. A platform was built in the northeast corner and all heavy repair parts for the shovels are stored in this building under cover.

The construction of the coal dock was started in May and is the extension of the track from the crusher to the East Tilden. As the ore trains will run over the dock, the construction is heavier than our regular docks. The dock has a capacity of 150 tons of steam coal, one car of black-smith coal and a car of coke. As soon as the dock was completed a loading pocket was constructed at the east end of the dock along the track connecting the main line of the L.S. & I. Ry. with the mine tracks at the crusher plant.

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12. NEW CONSTRUCTION
AND PROPOSED
NEW CONSTRUCTION:
(Continued)

E & A. No. 514 - Opening & Equipping Tilden Mine: (Continued)

The coal is pulled up a slide from the end of the dock to the top of the loading pocket by a 15 H.P. scraper-hoist. One hour's scraping twice a week will keep the locomotives supplied for a single shift operation. This coal loading plant has reduced the labor cost and time of coaling the locomotives.

E & A. No. 592 A and B:

Early in the summer when it was realized that the ore movement was going to be slow and that the season's requirements could be secured on a one shift operation, it was decided to start opening the East Deposit. We had to maintain a track crew of eight men to handle the work that arose, but there was not sufficient work at all times to keep them employed. With the opening up of the East Deposit any surplus labor at the West Pit was used in clearing, blasting stumps, track grading, stripping, etc. in connection with this new operation. There were also several periods when loading of ore in the West Pit was stopped entirely for a week or more. At such times a large part of the crew was kept working and employed on the opening of the East Pit.

About 600 feet of track was graded and laid from the end of the coal dock to the point where mining will start. The grading was done with the tractor and rotary scraper and a 50 H.P. scraper-hoist.

The stripping of the East Deposit covered by E & A. No. 592A is described under caption No. 7, "Open Pit Operations."

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13. EQUIPMENT
AND
PROPOSED
EQUIPMENT:

d. Drilling Equipment:

A new all steel No. 29 Armstrong Churn Drill was purchased in July from The Armstrong Manufacturing Co. at Waterloo, Iowa. The machine was purchased on E & A. No. 594 at a cost of \$ 4,982.71.

14. MAINTENANCE
AND REPAIRS:

1. Shovels:

The No. 29 electric shovel was thoroughly overhauled, renewing many of the worn parts and strengthening others. This machine was continually breaking down during 1929 and caused many serious delays. The bearings on the motor generator sets of both shovels gave a lot of trouble due to improper lubrication. This condition was overcome by installing an oil pump and giving a forced feed of oil to these bearings. We had little or no trouble from this cause during the past season.

The No. 31 shovel, which was new in July 1929, was gone over, cleaned up, all bolts and bearings tightened and adjustments made. Reinforcing clamps were put on the shipper shaft the same as placed on the No. 29.

The repair work to be done during the winter of 1930-31 to this equipment will be very light.

2. Locomotives:

The two 40-ton locomotives purchased from the Oliver in December 1929 were gone over and put into running condition. The water tanks were leaking in the bottom and a three inch layer of concrete was put in the bottom.

The No. 4 locomotive, which was purchased in the summer of 1929 from the Biwabic Mining Co., was overhauled. New pistons were installed as the old ones were badly worn, causing a loss of power and waste of fuel.

3. Cars:

During the season of 1929 we found that the shape of the Easton duplex body cars was not very satisfactory for the Tilden service. In order to load them to near capacity, there was considerable spillage which increased the expense in shifting the track, as the ties had to be dug out by hand as the dirt spilled packed in tight between them. The Easton Car and Construction Company sent their engineer to make a study of our conditions. They agreed to our recommendation and one side of the car was built up to a vertical side, and the other or dumping side, was extended 18 inches. These changes permitted loading to the original estimated capacity with practically no spillage. During 1929 it took two of the pit cars (four bodies) to fill a railroad car, while with the extra capacity provided by the change, 1.4 cars (or less than three bodies) filled a railroad car during the 1930 season.

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14. MAINTENANCE
AND REPAIRS:
(Continued)

4. Crushing Plant:

The two ten-inch crushers were completely overhauled. New concaves were put into the west crusher and the eccentrics on both were rebabbitted. Changes were also made in the discharge from these crushers onto the conveyor belt, as we had experienced trouble with the outlet choking.

The 42-inch crusher was overhauled during February. A complete new lower set of concaves were installed. At first it was thought that it would be necessary to install a new lower segment of the mantle. Instead of doing this the lower concaves were set out one inch by putting an inch strap iron behind them. In the future we will order these concaves one inch thicker. In order to renew the lower ones, the two upper rows had to be taken out and all rebabbitted. A new spider cap of cast steel was put on the crusher.

The bar grizzly was installed in a permanent manner with manganese wearing plates on top of the bars. This grizzly gave no trouble throughout the season and took out a larger portion of fines than did the revolving grizzly originally installed.

The pocket feeding into the 42" crusher was torn out and rebuilt. The old pocket was built on an angle from the track level to the edge of the crusher and was difficult to hold in place when dumping this chunky ore.

The new pocket is nothing more than a flat bottomed box. The ore fills in until it forms the angle of repose, forming the bottom or slide. We had no expense whatever in connection with this pocket during 1930, while in 1929 a crew of carpenters spent almost their entire time bracing and repairing it.

The conveyor belt was worn out the first season of operations. The Duplex conveyor system of the Boston Woven Hose & Rubber Company was installed and proved very satisfactory. As our 1930 tonnage was small we cannot as yet say if it will show any saving. The original belt is used as a power belt and a new sheet is put on top to carry the ore load. The advantage of this wear sheet or pad is that it is constructed with a 3/8 inch rubber cover instead of 3/16 inch as was the original conveyor belt. The extra thickness of rubber, which takes the wear of the ore, will give additional life to the belt at very little extra cost. When this duplex system was installed we changed the type of take up or tightener to a tail pulley at the bottom end of the conveyor. This change will also increase the life of the conveyor belt.

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14. MAINTENANCE
AND REPAIRS:
(Continued)

4. Crushing Plant: (Continued)

Changes were made in the car dumping arrangement. The hoist was set in the top of the crusher building over the cars instead of on a platform below the track grade. The hoist is equipped with a solenoid brake, which permits the dumping of the car and holding it at any point in order to allow the ore to run out slowly and not choke the crusher.

During the course of repairs to the 42" crusher it was discovered that the beams in the upper part of the crusher building were not strong enough to handle the belt when changing mantles. Further, the columns to the north were too close to the cars when dumping at the crushing plant. These changes were made during the early part of April.

18. NATIONALITY
REPORT:

<u>Nationality</u>	<u>No.</u>	<u>%</u>
English -----	23	40.3
Irish -----	9	16.0
Finnish -----	15	26.3
Norwegian -----	1	1.7
Swedish -----	6	10.5
French -----	3	5.2
Total -----	57	100.0%

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1. GENERAL:

The mine operated six days per week from January 1st to July 1st, five days per week from July 1st to December 11th, and four days per week from December 11th to December 31st.

The working force was maintained at practically a constant figure during the year and the labor turnover was unusually low. In November and December a few men were put on a half time schedule to make room for some old employees of the company that were laid off at the Holmes Mine following the sale of this property to the U. S. Steel Corporation.

A further advance in mining practice was made early in 1930 with the adoption of wire fencing to be laid on top of the covering down poles for mat. The fencing binds the mat together and prevents runs of rock, thereby increasing safety and grade of output. It has not been in use long enough to get the full benefit, due to the large area of the sub levels, but it has already demonstrated its value.

Three transfer systems were developed during the year; these with the two that were opened in 1929 made five in operation in December 1930. The transfer systems reduce rock development costs and speed up mining in the territory where they are operated.

All the ore mined in 1930 was handled by scrapers to the raises. The need of standard 15 h.p. units to replace the $6\frac{1}{2}$ electric and air hoists is imperative due to the limited area of operation, small capacity, and excessive repair costs of these low powered hoists. During the year six standard 15 h. p. electric hoists were purchased and during the next two years purchases must be continued until all the small units are replaced.

The new Ilgner hoisting set went into operation in April and an immediate improvement was noted in handling the loaded skips, also the time required to hoist was reduced. Later in the year the skip capacity was increased nearly one ton by removing the false bottom from the skips; this was not possible with the old Ilgner hoisting set due to lack of power.

The decrease in shipments from stockpile this year made it necessary to provide additional stocking ground to take care of the product after the steel trestles were filled. A new area was prepared to the North of the East steel trestle and at the end of the year a wooden trestle was being built from the curve on the permanent steel trestle to the new stocking ground. The steel trestles will be filled in February; the product will then be stocked on the new ground until shipping starts.

The 4-ton side dump main line cars were replaced in 1930 with 4-ton solid body rocker dump cars. The new tram cars eliminate spillage along the main haulage drifts, improve haulage conditions, and for a considerable time will eliminate repairs to cars. The expenditure for these cars will be made up in less than two years through savings in operating costs.

Stoping was completed above the 10th level in the area on the footwall near the Maas Mine boundary. By the end of the year this area was mined on the 10th level and work was in progress on the first sub under the 10th level. The ore body has been much smaller than on the subs above and the output from this territory has decreased.

Stoping was continued on a number of sub levels between the 10th and 11th levels on both the North and South footwall. Mining of a small area on the North footwall was delayed due to crushing of the 11th level haulage drifts but this has been overcome by two transfer systems; the ore is now sent to the 12th level.

NEGAUNEE MINE
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1. GENERAL: (Cont)

A large area in the center of the ore body was being mined on the elevation of the 11th level at the end of the year. Mining of the area under the hanging on the 11th level and first sub below was completed in 1930 and by the end of the year mining was underway in this area on the 2nd and 3rd subs below the 11th level. All the Bessemer ore produced in 1930 came from this area. The phosphorus is not uniform and only a small tonnage of Bessemer was produced.

Development work was continued on the 12th level; No. 7 crosscut was completed across to the drift that parallels the Maas boundary and a number of raises were put up to the 11th level and subs above.

Cutting of the plat on the 13th level, preliminary to sinking 80 ft. for skip pit and pocket, was started in November and will be continued until completed, after which the 13th level will be opened.

The grade of ore produced in 1930 showed a slight improvement as compared with 1929.

The mine was in good shape at the close of the year. It is developed for a large production, at least 650,000 tons, that can be obtained on short notice after increasing the working schedule to six days per week.

I regret to report that a fatal accident occurred in June, due to a sudden movement in the mat that rode a cap off a leg and buried two men. One was gotten out practically uninjured, the other was instantly killed. The ground was very heavy in this area just above the 11th level.

The work of standardizing all underground operations was continued in 1930 and will soon be completed. Monthly meetings of foremen by districts, started in December 1930, is expected to prove of great benefit in teaching the standards and keeping up enthusiasm for safety. Discipline has been stressed during the year with good results. Every effort is being made to eliminate accidents and in spite of no apparent improvement in the year's record progress has been made.

2. PRODUCTION,
SHIPMENTS &
INVENTORIES:

a. Production by Grades:

	<u>1930</u>	<u>1929</u>	<u>Increase</u>	<u>Decrease</u>
Negaunee Bessemer Ore	24,428	26,210		1,782
Negaunee Ore	555,312	529,709	25,603	
Total Ore	579,740	555,919	23,821	
Rock	16,760	17,092		332
Total Hoist	596,500	573,011	23,489	

The product increased 23,821 tons in 1930, and would have been much larger if the working schedule had not been reduced in July.

b. Shipments

<u>Grade of Ore</u>	<u>Pocket Tons</u>	<u>Stockpile Tons</u>	<u>Total Tons</u>	<u>Total Last Year</u>
Negaunee Bessemer		2,498	2,498	22,434
Negaunee Ore	314,591	100,287	414,878	615,526
Total	314,591	102,785	417,376	637,960
Total Last Year	370,096	267,864	637,960	
Decrease	55,505	165,079	220,584	

There was a decrease of over 30% in shipments in 1930. They were 122,364 tons less than the product for the year.

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2. PRODUCTION,
SHIPMENTS &
INVENTORIES:

c. Stockpile Inventories:

<u>Grade of Ore</u>	<u>Dec. 31, 1930</u>	<u>Dec. 31, 1929</u>	<u>Increase</u>	<u>Decrease</u>
Negaunee Bessemer	31,490	9,560	21,930	
Negaunee Ore	188,910	48,476	140,434	
Total	220,400	58,036	162,364	

Ore in stock increased 162,364 tons as compared with 1929.

d. Division of Product by Levels:

The ore hoisted from the various levels was as follows:

	<u>1930</u>		<u>1929</u>	
10th Level	50,143	8.5%	63,253	11.4%
11th Level	408,580	70.5%	246,264	44.3%
12th Level	121,017	21.0%	246,402	44.3%
Total	579,740	100 %	555,919	100 %

e. Production by Months:

The production by months is as follows:

<u>Month</u>	<u>Bessemer</u>	<u>Negaunee</u>	<u>Total</u>	<u>Rock</u>
January	5,092	46,653	51,745	1,896
February	3,324	43,850	47,174	1,432
March	5,140	48,397	53,537	760
April	4,496	44,669	49,165	1,676
May	3,724	53,502	57,226	2,512
June	264	54,469	54,733	1,544
July	0	46,173	46,173	572
August	352	45,748	46,100	496
September	0	46,687	46,687	1,920
October	1,888	47,411	49,299	1,604
November	0	39,990	39,990	912
December	148	37,763	37,911	1,436
Total	24,428	555,312	579,740	16,760
Transferred from	0	0	0	
Stockpile Overrun	0	0	0	
Total	24,428	555,312	579,740	
Total 1929	26,210	529,709	555,919	17,092
Increase		25,603	23,821	
Decrease	1,782			332

The product was distributed as follows:

	<u>1930</u>	<u>1929</u>	<u>Increase</u>	<u>Decrease</u>
Negaunee Mine	569,656	541,743	27,913	
American Mining Co.	10,084	14,176		4,092
Total	579,740	555,919	23,821	

NEGAUNEE MINE
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2. PRODUCTION,
SHIPMENTS &
INVENTORIES:

f. Ore Statement

	Negaunee <u>Bessemer</u>	Negaunee	Total	Total <u>Last Year</u>
On Hand Jan. 1, 1930	9,560	48,476	58,036	39,679
Product for Year	24,428	555,312	579,740	552,417
Overrun	0	0	0	103,900
Transferred from	0	0	0	
Total	<u>33,988</u>	<u>603,788</u>	<u>637,776</u>	<u>695,996</u>
Shipments	<u>2,498</u>	<u>414,878</u>	<u>417,376</u>	<u>637,960</u>
Balance on Hand	31,490	188,910	220,400	58,036
Decrease in Output			58,220	
Increase in ore on hand			162,364	

1930 - 1-8 hour shift, 6 days per week, January 1st to July 1st; 5 days per week July 1st to December 11th; 4 days per week December 11th to December 31st.

1929 - 1-8 hour shift, 6 days per week, January 1st to December 31st.

g. Delays

The non-electrical delays were as follows:

March 15th - one day - on account of changing skip hoist armature.

h. Delays from Lack of Current:

None.

3. ANALYSIS:

a. Average Mine Analysis on Output

<u>Grade</u>	<u>Iron</u>	<u>Phos.</u>	<u>Silica</u>
Negaunee Bessemer	61.70	.049	6.08
Negaunee	60.20	.093	7.08

The average mine analysis on output was practically the same in 1930 and 1929 for the Bessemer grade, but in 1930 the Negaunee grade averaged .34% higher in iron.

b. Average Analysis on Straight Cargoes

<u>Grade</u>	<u>Mine</u>		<u>Lake Erie</u>	
	<u>Iron</u>	<u>Phos</u>	<u>Iron</u>	<u>Moist</u>
Negaunee Bessemer	62.03	.047	61.28	9.31
Negaunee Crushed	60.20	.095	60.29	11.02
Negaunee Ore	60.09	.091	None	

Average analysis on straight cargoes to Lake Erie averaged slightly higher in 1930.

c. High Sulphur Ore

No high sulphur ore was encountered during the year in mining or development work.

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4. ESTIMATE OF
ORE RESERVES:

a. Developed Ore

Assumption: 12 cubic feet equals one ton
10% deducted for rock
10% deducted for loss in mining

Percentage of Bessemer equals 8%

Above 9th Level:

No. 1 Shaft Pillar	1,148,681 Tons
No. 2 Shaft Pillar	<u>113,906</u> "
Total above 9th Level	1,262,587 "
Between 10th and 11th levels	940,383 "
Between 11th and 12th levels	<u>1,957,119</u> "
Total Developed ore - all available	4,160,089 "
Total Developed ore last year	<u>4,702,191</u> "
Decrease 1930	542,102 "

The difference between the 1930 and 1929 estimates is 542,102 tons, which shows an increase in ore reserves of 37,638 tons due to a flattening of the hanging in the Southwest part of the mine below the 11th level. The ore remaining on January 1, 1930, above the 10th level, exclusive of No. 1 and No. 2 shaft pillars, was mined during 1930. This estimate does not show any prospective ore below the 12th level, but any ore that is here will be shown when the 13th level is developed to the ore body in 1931 and 1932.

b. Prospective Ore

There is no prospective ore shown in this estimate. The ore below the 12th level will be shown when the 13th level is opened and the ore body outlined by drifts and raises.

c. Estimated Analysis

Ore Reserves: Approximate Expected Natural Analysis.

	<u>Iron</u>	<u>Phos.</u>	<u>Silica</u>	<u>Mang.</u>	<u>Alum</u>	<u>Lime</u>	<u>Mag.</u>	<u>Sul.</u>	<u>Igni.</u>	<u>Moist</u>
Bessemer	52.80	.044	5.80	.220	2.30	.90	.290	.008	1.50	12.00
Negaunee	52.50	.095	6.50	.210	2.60	1.20	.360	.009	2.10	12.00

Ore in Stock: Average Natural Analysis:

	<u>Iron</u>	<u>Phos.</u>	<u>Silica</u>	<u>Mang.</u>	<u>Alum</u>	<u>Lime</u>	<u>Mag.</u>	<u>Sul.</u>	<u>Igni.</u>	<u>Moist</u>
Bessemer	54.50	.044	5.60	.210	2.20	.95	.280	.008	1.35	11.50
Negaunee	52.40	.080	7.00	.200	2.55	1.10	.380	.010	1.94	12.00

5. LABOR AND WAGES:

a. Comments

(1) Labor

There was an excess of labor available the entire year. In the Fall many men returned from the industrial centers which further increased the number of idle men.

(2) New Construction

The following is a list of the E & A's on which work was done in 1930:

E & A #531 - Vacation of Maas, Lonstorf & Mitchell Addition (moving 21 houses) and Extension of Healy Ave. - Negaunee Mine Company 37 $\frac{1}{2}$ % - The C. C. I. Co. 62 $\frac{1}{2}$ % - completed.

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5. LABOR AND WAGES:a. Comments: (Cont)(2) New Construction: (Cont)

- E & A #557 - New Ilgner Hoisting Set - completed.
- E & A #558 - Electric Haulage Generator Set - completed.
- E & A #574 - Rocker Dump Cars - completed.
- E & A #578 - Feather Valves for Nordberg Compressor - completed.

These E & A's will be taken up in detail under the heading #12 - "New Construction and Proposed New Construction".

b. Comparative Statement of Wages and Product

	<u>1930</u>	<u>1929</u>	<u>Increase</u>	<u>Decrease</u>
PRODUCT	579,740	555,919	23,821	
No. Shifts and Hours	1-8 hr	1-8 hr		
<u>AVERAGE NO. MEN WORKING:</u>				
Surface	52	48	4	
Underground	<u>216</u>	<u>207</u>	<u>9</u>	
Total	268	255	13	
<u>AVERAGE WAGES PER DAY:</u>				
Surface	4.36	4.32	.04	
Underground	<u>5.20</u>	<u>5.11</u>	<u>.09</u>	
Total	5.03	5.03	0	
<u>WAGES PER MONTH OF 25 DAYS:</u>				
Surface	109.00	108.00	1.00	
Underground	<u>130.00</u>	<u>127.75</u>	<u>2.25</u>	
Total	125.75	125.75	0	
<u>PRODUCT PER MAN PER DAY:</u>				
Surface	36.65	36.43	.22	
Underground	<u>9.34</u>	<u>8.87</u>	<u>.47</u>	
Total	7.44	7.13	.31	
<u>LABOR COST PER TON:</u>				
Surface	.119	.119	0	
Underground	<u>.557</u>	<u>.577</u>		<u>.02</u>
Total	.676	.696		.02
<u>AVERAGE PRODUCT MINING:</u>				
Stoping	22.61	20.77	1.84	
Ore Development	<u>9.31</u>	<u>9.41</u>		<u>.10</u>
Total	21.69	20.00	1.69	
AVERAGE WAGES CONT. LABOR	5.82	5.53	.29	
<u>TOTAL NUMBER OF DAYS:</u>				
Surface	15,819	15,259 $\frac{3}{4}$	559 $\frac{1}{4}$	
Underground	<u>62,041</u>	<u>62,711$\frac{1}{2}$</u>		<u>670$\frac{1}{2}$</u>
Total	77,860	77,971		111
<u>AMOUNT FOR LABOR:</u>				
Surface	68,982.60	65,949.32	3,033.28	
Underground	<u>322,793.73</u>	<u>320,745.25</u>	<u>2,048.48</u>	
Total	391,776.33	386,694.57	5,081.76	

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5. LABOR AND WAGES:

b. Comparative Statement of Wages and Product: (Cont)

Proportion of Surface to Underground Men:

1930 - 1 to 4.30	1-8 hr. shift 6 days per week, Jan. 1st to July 1st
	1-8 hr. shift 5 days per week, July 1st to Dec. 11th
	1-8 hr. shift 4 days per week, Dec. 11th to Dec. 31st
1929 - 1 to 4.31	1-8 hr. shift 6 days per week
1928 - 1 to 4.79	1-8 hr. shift 6 days per week, Jan. 1st to April 9th
	1-8 hr. shift 5 days per week, April 9th to Oct. 1st
	1-8 hr. shift 6 days per week, Oct. 1st to Dec. 31st
1927 - 1 to 4.81	1-8 hr. shift 5 days per week, Jan. 1st to March 12th
	1-8 hr. shift 6 days per week, March 12th to Dec. 31st
1926 - 1 to 4.89	1-8 hr. shift 5 days per week

6. SURFACE:

a. Buildings, Repairs:

The dry house roof was repaired, treated with filler, and then asbestos roof paint.

The coal dock trestle and chute to the coal storage bin in the boiler house was repaired and a new puffer house built on the North side of the boiler house to enclose the air puffer used to pull the coal car.

A new building was erected on the South side of the garage to store the fire hose. The fire hose was previously stored in the boiler house which was quite inaccessible in the winter time as it was some distance from the mine roads.

A new storage shed was built near the shops for plate. This shed was covered with toncan metal.

The upper part of the shaft house enclosure near the skip compartments was enlarged in order to make more room for working on the skip dumps and runners. The entrance to the skip compartment at the collar of the shaft was enclosed in order to protect the men when they have work on the skips in cold weather and also to facilitate changing skips in the winter.

b. Stockpiles:

The girders of the steel trestle was painted with No. 9 Red Portland Sement Paint and a number of ties replaced under the tracks on the trestle. Four additional bents were erected on the rock trestle.

A new stockpile ground was prepared in October and November North of the East steel trestle. Near the East end of this new ground there was a gully and at the West end a high sand bank. Four cuts were made through the bank, the gully filled and the extra material was dumped further to the East along the railroad track to the mine. There was a total of 30,880 yards of sand moved, the company providing shovel and crew for this work, the railroad company providing train crew and cars for moving the material. When the work by steam shovel was completed the ground was levelled and five cars of 2 and 3" sollar plank laid on the new stocking grounds. This covered sufficient ground to take care of the ore hoisted until shipping season next year. The last of the year work started on the permanent trestle which joins the steel trestle on the curve of the permanent steel trestle.

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6. SURFACE:

c. Tracks, Roads, etc.:

A road was built to the new addition to the engine house and the shrubbery rearranged in this area.

A hot well was excavated in the boiler room and lined with concrete. This well is 8 ft. deep and $3\frac{1}{2}$ ft. in diameter. At the end of the year return lines were being installed from the laboratory, crusher house, engine house, dry, and office buildings to carry the water from the condensed steam back to the hot well, from which point it will be handled by pump directly to the boilers.

d. Timber Yard:

Two railroad tracks in the lagging yards were removed by the railroad as they were not needed for handling lagging.

e. Grounds

The fence was moved at the Northwest corner of the grounds near the office a considerable distance to the North to bring it in line with the fence further to the East. This improved the approach to the mine and makes the enclosed area much more attractive.

7. UNDERGROUND:

a. Shaft Sinking

There was no shaft sinking at the Negaunee Mine in 1930 but work was started in November excavating the 13th level to make room for the regular shaft station. When the shaft was sunk several years ago it was bottomed on the 13th level and some ground excavated for skip pit pocket. When sufficient ground is removed on the plat the shaft will be sunk 80 ft. below the 13th level for the loading pockets and skip pit. Sinking will start in the Spring of 1931. It will have to be done on the night shift between 11 P. M. and 7 A. M. so as to not interfere with hoisting.

b. Development:

Development work for the year consisted of main level drifting on the 10th, 11th, and 12th levels, installing of three new transfer systems on the North and East footwall between the 11th and 12th levels and raising on the 11th and 12th levels.

10th Level:

In the Northwest end of the mine a new footwall drift was driven 55 ft. in jasper and dike to connect with the second footwall drift on the 2nd level, Maas Mine. This drift improves ventilation and provides another outlet in rock between the mines.

11th Level:

In December 1929 a drift was started from the shaft crosscut between No. 1 and 2 dikes. During 1930 it was continued and holed to the East footwall drift. This drift passed through 163 ft. of ore and 320 ft. of rock. Ten double compartment raises were put up from this drift to the 488 and 500 ft. subs and 10th level, a total of 945 ft. of ore raising and 45 ft. of rock raising.

Another crosscut between No. 1 dike and the footwall was started in June 1930 and at the end of the year was nearly completed to the footwall drift. This drift passed through 335 ft. of rock and 65 ft. of ore, whereas it had been expected it would be in ore for the greater part of its length.

Three raises were put up from the East footwall drift during the year.

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7. UNDERGROUND:b. Development: (Cont)12th Level:

One transfer system was installed on the East footwall near No. 2 dike. It was started from 1207 raise at an elevation of 370 ft., or 70 ft. above the 12th level, and was driven 140 ft. in footwall jasper.

Four single compartment raises were put up from this drift on the 370 ft. sub to the 425 ft. sub, which is 25 ft. above the 11th level.

Two other transfer systems were started late in the year on the North footwall to mine the ore lying on the footwall above the 11th Level. It was not possible to mine this ore on the 11th Level due to crushing of the haulage drifts so it was decided to mine it through a transfer sub level. At the end of the year three single compartment raises had been put up from each of these transfer systems to the 425 ft. sub level. One of these new transfers connect with 1288 raise and the other with 1284 raise from the 12th level.

No. 7 crosscut which was extended 185 ft. to the Northwest and holed to the drift parallel to the Maas boundary. This was the only drifting done on the 12th level in 1930. A total of sixteen raises were put up during 1930 for a total of 1265 ft. of ore and 390 ft. of rock raising.

The summary of development work for the year is as follows:

	Drifting		Raising		Total	Total 1929
	Ore	Rock	Ore	Rock		
10th Level		55'			55'	0'
11th Level	228'	655'	970'	95'	1,948'	1,551'
Transfer Systems		205'	351'	75'	631')	
12th Level		185'	1,265'	390'	1,840')	2,197'
Total	228'	1,100'	2,586'	560'	4,474'	3,748'

There was an average of six contracts on development work during 1930 as compared with five in 1929.

c. Stoping:(1) General Remarks:

In 1930 mining extended from the 520 ft. sub on the North footwall and the 10th level on the South footwall to the 3rd sub below the 11th level in the extreme Southwest end of the mine under the hanging. In the North footwall area near the Maas Mine two and one-half subs have been mined with an average of six contracts working here. On the South footwall, where there are two transfer systems in operation, nearly three subs have been completely mined. Mining the last of the year was under way here on the second sub below the 10th Level.

The majority of the contracts have been concentrated on the 11th level in the center of the ore body. Mining on the first sub above the 11th level in this area was practically completed in 1929.

Mining in the area under the hanging in the Southwest part of the mine was confined to the first, second, and third subs below the 11th level. The third sub was opened in November 1930.

The mine has been very heavy during the year and even the new drifts on the 11th level have had to be lined with additional sets and in some cases new chutes built in the raises. The only wet area has been in the 1260 system of raises where only a few contracts have been employed.

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7. UNDERGROUND:

c. Stoping: (Cont)

(1) General Remarks: (Cont)

Scrapers have been used by all contracts for handling ore on sub levels to the raises. Additional larger units of 15 h. p. are being gradually purchased to replace the air and small electric units.

There was an average of 50 contracts working during 1930, $3\frac{1}{2}$ of which were on double shift, as compared with 46 contracts with six on double shift in 1929.

(2) Detail of Stoping:

Subs between the 9th and 10th levels:

520' Sub Level - North footwall:

Mining was started on this sub level in September 1929 and was completed in April 1930. All the ore was handled through raises from the 11th level. Mining is being done here in the pillar on the North footwall in the area adjacent to the Maas boundary.

10th Level - North footwall:

Mining at the elevation of the 10th level on the North footwall near the Maas boundary was started in March 1930 and with the exception of one small pillar left near 305 raise was completed at the end of the year. This pillar will be mined early in the coming year. There was 55 ft. of rock drift from the North footwall drift to make a connection with the Maas 2nd Level for ventilation and a second outlet between the two mines.

10th Level - South footwall - North of No. 1 dike:

Mining was started on the North side of No. 1 dike on the South footwall at the elevation of the 10th level in May 1928. Mining had to be abandoned here on account of water and heavy pressure. In 1930 several raises were put up from the new 11th level crosscut to the pillar remaining in this area near the West end of this small ore body. It was hoped that mining in adjacent areas had drained the water away but the area was so wet that it was found impossible to maintain the top of raises, and after working here only a month and connecting two of the raises it was necessary to again abandon work.

10th Level - South footwall - South of No. 1 dike:

Mining of the ore body lying on the South side of No. 1 dike was started in the summer of 1929 and completed early in 1930.

Subs above the 11th Level:

500' Sub Level - South footwall:

Mining of the area between No. 1 and 2 dikes was started in May 1929 and completed in April 1930. The ore was removed through the 450' transfer sub level, two transfer systems having been developed here in 1929. There is still a small pillar remaining at the West end of this deposit but it was not possible to mine it as there is still some ore above in this area at the elevation of the 10th level. This is the ore referred to in a previous paragraph where there was so much water and pressure that it was impossible to keep drifts and raises open.

Mining the area South of No. 1 dike was started in May 1930 and is still in progress. The ore is mined from raises direct to the 11th level. At the end of the year there were three contracts mining in this area.

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7. UNDERGROUND:

c. Stoping: (Cont)

500' Sub Level - North footwall:

Mining was started in the footwall pillar near the Maas boundary in October. The ore here is being handled through raises direct to the 11th level. At the end of the year there were five contracts slicing and one contract drifting.

488' Sub Level - South footwall:

Mining was started in the area between No. 1 and 2 dikes in March 1930 and there were seven contracts mining here at the end of the year. The greater part of the ore mined here has been removed through transfer raises connecting with the 450 transfer sub level. Late in the year several raises holed to this territory from the new 11th level crosscut and some ore from the West end of the present area has been removed through these raises as this area is beyond the mining limits of the transfer systems.

450' Sub Level:

Several small pillars adjacent to the North and East footwall were mined on this sub level during the past year, work being completed here in April.

440' Sub Level:

Mining on this sub level was started in 1926 and was not completed at the end of 1930. Work during the past year was confined to the mining of pillars in the North and Northeast part of the sub level. In the North area some pillars still remain. This area was originally developed by drifts and raises from the 11th level. Mining was in progress here until the middle of the year when the weight became so heavy that it was no longer possible to maintain the raises and haulage drifts on the 11th level. In order to mine the remaining pillars in this area in the North footwall, two transfer drifts were driven on the 385' sub level and a number of transfer raises put up.

425' Sub Level:

Work was started on this sub level in January 1928 and was not completed at the end of 1930. Mining in the area near the Maas boundary that was developed by the 1290 system of raises from the 12th level was completed in July.

Mining in the area North of No. 2 dike at the East end that was developed by raises from the 370' transfer sub was completed in September.

A considerable area remains to be mined near the North foot that has been recently developed by raises from the new 385 ft. transfer systems.

In December three contracts were mining on this sub, all working from the new transfer raises on the North footwall.

11th Level:

The new crosscut started in 1929 to develop the ore body between No. 1 and 2 dikes was completed in 1930. This drift advanced 485 ft. in 1930. During the year there were ten raises put up in this drift, some of which were extended to the elevation of the 10th level. The pressure on this drift has been very heavy and soon after it was completed it was necessary to start putting in lining sets and before the end of the year it was necessary to keep repair gangs here constantly. Some of the raises have crushed near the bottom so badly it has been necessary to build new chutes.

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7. UNDERGROUND:

c. Stoping: (Cont)

11th Level: (Cont)

To develop that portion of the ore body lying South of No. 1 dike it was decided to drive a new crosscut between the foot and hanging wall drifts. This new crosscut was started in July and had advanced a total of 400 ft. at the end of the year. It had been expected that it would be in ore for at least half of its length but only 65 ft. of ore was encountered and 335 ft. of rock.

The area near the Maas boundary that is tributary to the 1290 system of raises from the 12th level is now being mined. In December seven contracts worked in this area.

Six contracts were mining from the 1270 system of raises above the 12th level at the end of the year.

One contract was mining from the transfer raises above the 370 ft. transfer sub at the end of December.

Two contracts were mining from 1207 and 1208 raises at the end of the year.

One contract was driving the new crosscut South of No. 1 dike.

One gang was putting up a raise from the footwall drift in December.

There was a total of 19 contracts working on the 11th level during the month of December.

Subs above the 12th Level:

395' Sub Level:

This sub level was opened in June 1929 and during 1930 the area under the hanging at the Southwest end of the deposit as far North as the 1250 system of raises has been mined. Mining operations are under way at the present time in the territory immediately to the North developed by the 1260 system of raises from the 12th level. Five contracts were working here during December.

385' Sub Level:

Mining in the Southwest end of the deposit under the hanging at the elevation of this sub level was started in January 1930. Five contracts were working here in December.

On the Northeast side of the deposit on the foot two transfer drifts were driven to the North of the drift connecting the raises above No. 8 crosscut on the 12th level. Raises have been put up from these two transfer drifts for the purpose of mining pillars remaining on the 440 and 425 ft. sub levels. There was 70 ft. of ore drifting and 150 ft. of rock drifting done here in developing these two transfer drifts.

370' Sub Level:

The transfer drift that was started North of No. 2 dike near the end of last year was completed early in 1930 and four transfer raises put up to the elevation of the 425 ft. sub level. These transfer raises are used at the present time for handling ore being mined on the 11th level.

Mining was started in September in the Southwest end of the deposit under the hanging. This is the lowest elevation at which mining is being done. Four contracts were working here at the end of the year. The ore being mined here is handled through the 1230 and 1240 systems of raises above the 12th level.

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7. UNDERGROUND:c. Stoping: (Cont)12th Level:

No. 7 crosscut advanced a total of 130 ft. in ore during the year, holing to the drift parallel to the Maas boundary. There were no contracts working on the main level at the end of the year. During the year there were sixteen raises put up to the 11th level and subs above.

13th Level:

One contract started work on the 13th level the last of November cutting the plat near the shaft, and also excavated a small temporary sump, preparatory to sinking 80 ft. and opening up this level.

d. Timbering

The total cost for timber increased in 1930, due to larger product, to larger sizes of timber used, and to more repairing. The larger sizes of timber were used in retimbering main level drifts, also over raises and on sub levels, to insure safety to miners and maintain a second outlet on the sub level in areas under heavy pressure.

The cost per ton for timber increased slightly in 1930, due to more timber used per ton of ore. The amount and cost for cribbing timber used in raises was about the same in 1930 as in 1929. Expense for $9\frac{1}{2}$ ft. poles increased due to more poles used for covering down. Wire fencing was used the last six months of the year as additional covering on top of the poles. The total cost for the year increased nearly 1¢ per ton.

Statement of Timber Used:

	LINEAR FEET	AVG. PRICE PER FOOT	AMOUNT 1930	AMOUNT 1929
6 x 8" Cribbing	185,163	.0391	7,228.53	7,270.24
8 x 10" Stulls	128,052	.0612	7,839.16	6,796.72
10 x 12" "	65,977	.0908	5,992.47	4,811.80
12 x 14" "	34,272	.1095	3,753.70	2,337.04
14 x 16" "	3,392	.1400	475.02	
Athens Treated Timber	1,455	.432	628.56	1,571.31
Total - 1930	418,311	.0619	25,917.44	
Total - 1929				22,787.11
Lagging - 7 ft.	1,580,740	.720	11,383.27	10,599.29
Poles - $9\frac{1}{2}$ ft.	897,056	1.492	13,389.42	11,867.84
Covering Boards - 1"	9,975	22.20M	221.87	258.51
Total - 1930	1,487,771		24,994.56	
Total - 1929				22,725.64
Wire Fencing (2100 rds) sq.ft.	144,375	7.56Rd	1,588.62	
Grand Total - 1930			52,500.62	
Grand Total - 1929				45,512.75

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7. UNDERGROUND:d. Timbering: (Cont)Statement of Timber Used: (Cont)

	<u>AMOUNT</u> <u>1930</u>	<u>AMOUNT</u> <u>1929</u>
Product	579,740	555,919
Feet of timber per ton of ore	.7214	.6723
Feet of lagging per ton of ore	2.5670	2.5850
Feet of lagging per foot of timber	3.5560	3.8455
Feet of wire fencing per ton (266,160 tons)	.5424	-
Cost per ton for timber	.0447	.0410
" " " " lagging	.0196	.0190
" " " " poles	.0232	.0214
" " " " covering boards	.0004	.0005
" " " " wire fencing (in use only 6 months)	.0027	-
 Total cost per ton	 .0906	 .0819
 Equivalent of stull timber to board measure	 769,027	 623,169
Feet of board measure per ton of ore	1.327	1.121
 Total Cost for timber, lagging, poles, etc.	 <u>Amount</u>	 <u>Cost per ton</u>
1930	52,500.62	.0906
1929	45,512.75	.0819
1928	40,882.06	.0899
1927	36,003.44	.0738
1926	31,579.36	.0868
1925	29,572.15	.0844

e. Drifting and Raising:

There was more rock drifting on main levels in 1930, and less ore drifting; the net increase was 238 ft. of drifting. Ore and rock raising also show an increase as compared with 1929. Total drifting and raising increased 19% in 1930.

The following is a statement of drifting and raising for the years 1930 and 1929:

<u>Year</u>	<u>Drifting</u>		<u>Raising</u>		<u>Total</u>
	<u>Ore</u>	<u>Rock</u>	<u>Ore</u>	<u>Rock</u>	
1930	228'	1,100'	2,586'	560'	4,474'
1929	460'	630'	2,121'	537'	3,748'
Increase		470'	465'	23'	726'
Decrease	232'				

f. Explosives, Drilling and Blasting:

The cost per pound for powder decreased \$.0043 in 1930, the cost per ton of ore increased \$.0008, while the pounds of powder per ton of ore increased \$.0189. For several months a new powder, 1-x and 2-x, running more sticks to a 50 lb. box, was given a thorough trial and finally discarded. It did not break the ground as well, produced more smoke, and instead of effecting a saving in cost actually caused a small increase in the cost for the year. The cost of fuse and blasting caps was lower in 1930, resulting in a decrease of \$.0005 in the cost per ton. There was more ore raising in 1930, which work requires more powder than ordinary mining operations. This accounts for use of more 60% powder in 1930, also more 60% was used in hard, tough, ore. The cost for all explosives increased \$.0003 as compared with 1929; it was, however, \$.01 lower than in 1928.

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7. UNDERGROUND:f. Explosives, Drilling and Blasting: (Cont)Statement of Explosives Used: (Ore Development and Stoping)

	<u>Quantity</u>	<u>Average Price</u>	<u>1930 Amount</u>	<u>1929 Amount</u>
50% Powder - lbs.	121,650	.1309	15,929.98	23,431.51
60% " "	46,650	.1402	6,539.47	3,746.35
2-x " "	7,700	.1275	981.75	
1-x " "	50,350	.1067	5,371.65	
Total Powder - 1930	226,350	.1273	28,822.85	
Total Powder - 1929				27,177.86
Fuse - feet	662,871	.577	3,430.09	3,430.59
Caps - No. 6	99,236	.999	991.15	1,070.40
Cap Crimpers				4.68
Connecting Wire	2#		.82	6.68
Tamping Bags	18,300		43.58	29.69
Total Fuse, etc. - 1930			4,465.64	
Total Fuse, etc. - 1929				4,542.04
Total all explosives - 1930			33,288.49	
Total all explosives - 1929				31,719.90
Product			579,740	555,919
Lbs. of powder per ton of ore			.3904	.3715
Cost per ton - powder			.0497	.0489
" " " - fuse, caps, etc.			.0077	.0082
" " " - all explosives			.0574	.0571

Sinking, Rock Development, etc.

50% Powder - lbs.	850	.1297	110.25	903.50
60% " "	11,850	.1399	1,658.38	1,829.93
1-x " "	1,150	.1275	146.62	
Total Powder - 1930	13,850		1,915.25	
Total Powder - 1929				2,733.43
Fuse - feet	69,620	.577	402.72	309.02
Caps - No. 6	5,838		67.37	97.27
Connecting Wire				
Cap Crimpers				
Tamping Bags				
Total Fuse, etc. - 1930			470.09	
Total Fuse, etc. - 1929				406.29
Total all explosives - 1930			2,385.34	
Total all explosives - 1929				3,139.72
Total Explosives used in mine			35,673.83	34,859.62
Average price per lb. for powder			.1279	.1321
24.4% of all powder used in 1930 was 60%				
17.3% " " " " " 1929 " 60%				

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7. UNDERGROUND:

f. Explosives, Drilling and Blasting: (Cont)

There was 493 ft. more rock drifting and raising in 1930, but some of this work was on the sub levels, which required less powder than was used last year in excavating the sump on the 12th level.

g. Mining & Loading:

There were no changes in mining methods in 1930 but a number of improvements were made in the detail of the work. 9 ft. legs are now in general use on the sub levels and in some areas 9 ft. caps are used. Close attention is given to selection of proper size of timber, which is governed by the pressure. More attention has been given to covering down carefully so as to eliminate runs of rock, which dilute the ore and cause delays. 9½ ft. poles and wire fencing have been adopted as standard covering material.

All ore loaded underground is handled with scrapers. Experiments are under way with larger scrapers to use with the 15 h. p. hoists as further improvement must come from decreasing the time required to scrape the ore to the raise; this will give the miners more time to drill, blast, and timber. It will insure that the complete cycle will be made each day; this will raise tons stoping per day and decrease stoping cost.

	1930	1929	1930 % of	1929 % of
	<u>Tons</u>	<u>Tons</u>	<u>Product</u>	<u>Product</u>
Hand shovelling	0	13,494		2.5 %
Scrapers	579,740	538,923	100 %	97.5 %
Total	579,740	552,417	100 %	100.0 %

i. Ventilation:

The joint ventilation plant located at No. 2 shaft has operated satisfactorily during the year. Some trouble was experienced during the severe cold weather on account of ice in No. 2, the downcast shaft. A new connection was made between the Maas and Negaunee Mines early in 1930 when a new footwall drift was driven on the 10th level in the railroad pillar and holed to the second footwall drift on the 2nd level, Maas Mine.

No booster fans have been needed in the Negaunee Mine in 1930, as the sub levels have been kept open to the level above, permitting the air to pass through the sub to the lower level and thence to the Maas Mine.

There are now three connections between the Maas and Negaunee shafts and one between the Negaunee and Athens shaft, entirely in rock.

j. Pumping:

The number of gallons pumped per minute during 1930, 1929, and 1928, are shown below:

<u>Month</u>	<u>1930</u>	<u>1929</u>	<u>1928</u>
January	1,118	1,285	1,120
February	1,183	1,226	1,076
March	1,095	1,153	1,023
April	1,058	1,155	1,038
May	958	1,179	1,107
June	1,087	1,303	1,156
July	1,073	1,223	1,223
August	1,071	1,274	1,280
September	1,063	1,279	1,319
October	1,075	1,231	1,354
November	934	1,202	1,342
December	1,011	1,250	1,333
Total Average	1,060	1,230	1,198

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7. UNDERGROUND:

j. Pumping: (Cont)

The average number of gallons per minute pumped in the Negaunee Mine during 1930 decreased 170 gallons per minute as compared with 1929, due to more water in the caved area of the hanging going to the Maas Mine.

The average number of gallons pumped per minute over the last six years is as follows:

<u>Year</u>	<u>Gals. per minute</u>
1930	1,060
1929	1,230
1928	1,198
1927	1,144
1926	819
1925	705

k. Underground in General:

There has been a continued advancement in respect to the mechanization of the mine. Larger scraper hoists of 15 h. p. units are being purchased to gradually replace the smaller electric and air hoists and larger scrapers are in use with these larger units.

In 1929 more attention was given to the method of poling down on sub levels to increase safety and prevent dilution from runs of rock and in 1930 this was further augmented by the use of wire netting. The practice of using wire netting in the mines has been in use for some time on the Mesabi Range and was introduced on the Marquette Range mines in July 1930. The wire, which is a 4" diamond mesh wire fencing of 42" and 50" widths, is laid the full length of the completed slice on not less than six poles, which have been spiked to cross poles. The strips of wire fencing overlap 3" and extend up on the sides of the drift far enough to enable the wire to be bent down around the legs and cover the space between the slices. The first practice was to put the wire the entire length on the sides of the slice as is done on the Mesabi, but this did not work out here as the completed slice would not always cave and fill before starting the next one. This left the wire exposed and consequently it was often blasted and broken. It is now placed on the side of the slice where one side or the breast is exposed to rock and here it is reinforced with poles and blocking to insure keeping back the rock on the sub below. The wire has proven very satisfactory and should increase both the tons per man and the grade of the ore by keeping back the rock and thus eliminate runs, which take considerable time to forepole through. It will also increase safety as the wire will tend to tie the mat together in a much better manner and keep loose timber or rock from breaking through and causing serious and fatal accidents.

The mine has continued to show considerable weight and, therefore, has required a large number of men constantly repairing and relining the main level drifts. Nearly all the mining has been under the old mat, with only a few contracts working under new hanging on and below the 11th level.

There has been no unusual development work during the year, six contracts being employed in main level drifting and raising on the operating levels.

It is intended to sink the shaft 80 ft. below the 13th level for shaft pockets and skip pit, open up the 13th level, and drift toward the ore body in 1931.

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7. UNDERGROUND:k. Underground in General: (Cont)

36 new 4-ton rocker dump cars built by the Lake Shore Engine Works at Marquette, and equipped with Williston couplers, were installed in 1930 to replace the former saddleback cars. The tracks at the pockets were moved to one side as these rocker dump cars dump on one side; a suitable buffer was built for the car body to strike when dumped. The rocker dump cars have proven very satisfactory and have almost eliminated track cleaning away from the chutes. A car repairer is no longer necessary as there are very few movable parts on these cars to get out of order, and it should be several years before any extensive repairs are necessary.

8. COST OF OPERATING:a. Comparative Mining Costs:

	<u>1930</u>	<u>1929</u>	<u>Increase</u>	<u>Decrease</u>
PRODUCT	579,740	555,919	23,821	
Underground Costs	.997	1.013		.016
Surface Costs	.128	.126	.002	
General Mine Expenses	.155	.168		.013
Cost of Production	1.280	1.307		.027
Depletion - Original Cost	.092	.110		.008
Increment	.314	.375		.061
Depreciation - Plant & Equipment	.031	.037		.006
Development		.001		.001
Movable Equipment	-	-		
Taxes	.329)	.355)		
Taxes - Franchise	.002)	.002)		.026
Loading and Shipping	.014	.023		.009
Total Cost at Mine	2.062	2.210		.148
Administrative & General Expenses	.018	.029		.011
Miscellaneous Income (Red)	.008	.010		.002
Obsolete Supplies	-	-		
Supply Inventory Adjustment	-	-		
TOTAL COST	2.072	2.229		.157
No. of Days Operated	276	299		23
No. Shifts & Hours	1-8 hr	1-8 hr		
Average Daily Product	2,100	1,859	241	

COST OF PRODUCTION

	<u>1930</u>	<u>-</u>	<u>%</u>	<u>1929</u>	<u>-</u>	<u>%</u>	<u>Decrease</u>
Labor	.687		53.7	.711		54.4	.024
Supplies	.593		46.3	.596		45.6	.003
Total	1.280		100.0	1.307		100.0	.027

b. Detailed Cost Comparison:(1) Days and Shifts:

<u>Year</u>	<u>Days Worked</u>	<u>Shifts & Hours</u>	<u>Men Employed</u>	<u>Total Days Worked</u>
1930	276	1-8 hr	268	77,860
1929	299	1-8 hr	255	77,971
Increase			13	
Decrease	23			111

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8. COST OF
OPERATING:

b. Detailed Cost Comparison: (Cont)

(2) Wages:

The mine operated on the same wage schedule in both 1930 and 1929.

(3) Comparison of Production:

Production - 1930	579,740 tons
Production - 1929	555,919 "
Increase	23,821 "

(4) Comparison of Number of Men and Wages:

	<u>No. Men.</u>	<u>No. Days</u>	<u>Amount</u>	<u>Rate per day</u>
1930	268	77,860	391,776.33	\$ 5.03
1929	255	77,971	386,694.57	5.03
Increase	13		5,081.76	
Decrease		111		

(5) Tons per man per day:

The tons of ore mined per man per day were as follows:

	<u>1930</u>	<u>1929</u>	<u>Increase</u>	<u>Decrease</u>
Surface	36.65	36.43	.22	
Underground	9.34	8.87	.47	
Total	7.44	7.13	.31	

(6) Cost of Production:

1930	\$742,148.15	Cost per ton	\$1.280
1929	726,829.09	" " "	1.307
Increase	15,319.06	Decrease	.027

	<u>Total Cost</u>				<u>Cost per ton</u>		
	<u>Labor</u>	<u>%</u>	<u>Supplies</u>	<u>%</u>	<u>Labor</u>	<u>Supplies</u>	<u>Total</u>
1930 -	\$398,430.45	53.7	\$343,717.70	46.3	\$.687	\$.593	\$1.280
1929 -	395,258.41	54.4	331,570.68	45.6	.711	.596	1.307
	3,172.04	.7	12,147.02	.7	.024	.003	.027
	Incr.	Decr.	Incr.	Incr.	Decr.	Decr.	Decr.

The ratio of labor to supplies changed again in 1930, with a further small increase in supplies. It is probable that the ratio will stand in future years quite close to this year's figures as the mechanization of the mine is now about completed. Replacement of the small scraper hoists with 15 and 20 h. p. units will continue for several years.

The decrease in cost per ton is due to the larger product. Tons per man per day increased 4%, while cost per ton decreased 2%. The reduced schedule of operation the last six months of the year rendered it impossible to continue the low cost obtained during the first six months.

(7) Detail of Accounts:

UNDERGROUND COSTS:

Exploring:

1930 Amount	\$262.10	Cost per ton	\$.001
1929 Amount	399.27	" " "	.001
Decrease	137.17		

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8. COST OF
OPERATING:

Sinking

1930 Amount	\$535.01	Cost per ton	\$.001
1929 Amount	-	" " "	-
Increase	535.01	Increase	.001

Increase due to cutting plat on 13th level.

Development in Rock

1930 Amount	\$11,363.45	Cost per ton	\$.020
1929 Amount	9,413.24	" " "	.017
Increase	1,950.21	Increase	.003

	<u>Sub Division</u>			
	<u>Drifting</u>	<u>Raising</u>	<u>Total Ft.</u>	<u>Cost per Ft.</u>
1930	1,100'	560'	1,660'	\$ 6.85
1929	797'	537'	1,334'	7.06
Increase	303'	23'	326'	
Decrease				.21

The amount of rock drifting increased 38%, while rock raising decreased 4.3%.

The cost per foot for 1929 decreased \$.21 per ft.

Development in Ore

1930 Amount	\$13,697.17	Cost per ton	\$.024
1929 Amount	13,142.74	" " "	.023
Increase	554.43	Increase	.001

	<u>Sub Division</u>			
	<u>Drifting</u>	<u>Raising</u>	<u>Total Ft.</u>	<u>Cost per Ft.</u>
1930	228'	2,586'	2,814'	\$ 4.87
1929	460'	2,121'	2,581'	5.09
Increase		465'		
Decrease	232'		233'	.22

The increase is due to more ore raising. Drifting decreased 232 ft., or 50.4% in 1930; this decrease was more than offset by the increase in raising.

Stoping

1930 Amount	\$225,493.79	Cost per ton	\$.389
1929 Amount	223,939.89	" " "	.403
Increase	1,553.90	Decrease	.014

	<u>Labor</u>		<u>Supplies</u>	
1930 -	\$158,818.48	70.4%	\$66,675.31	29.6%
1929 -	157,876.34	70.5%	66,063.55	29.5%

	<u>Cost per ton</u>		
	<u>Labor</u>	<u>Supplies</u>	<u>Total</u>
1930	\$.274	\$.115	\$.389
1929	.284	.119	.403
Decrease	.010	.004	.014

During this year the following scraper hoists were purchased:
4 15 h. p. Sullivan scraper hoists costing \$4,614.72
1 6 H. C. Tugger Hoist costing \$647.90
2 15 h. p. Ingersoll Rands costing \$2,564.76
Total cost new equipment \$7,827.38.

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8. COST OF
OPERATING:

Stoping: (Cont)

The cost for stoping shows a decrease of \$.014. This is due to use of additional larger scraper hoists and scrapers, and to better operating conditions on the sub levels on account of covering down more carefully.

Timbering

1930 Amount	\$143,014.78	Cost per ton	\$.247
1929 Amount	<u>124,485.62</u>	" " "	<u>.223</u>
Increase	18,529.16	Increase	.024

Detailed Cost of Timber

	<u>1930</u>	<u>1929</u>
Timber Cost	\$25,917.44	\$22,787.11
Lagging, Poles, Cover Boards, and Wire Fencing	<u>26,583.18</u>	<u>22,725.64</u>
Total	52,500.62	45,512.75
Feet of timber per ton of ore	.7214	.6723
Feet of lagging per ton of ore	2.5670	2.5850
Cost per ton for all timber	.0906	.0819
Feet of wire netting per ton of ore (sq.ft)	.5424	-
Cost per ton for wire netting	.0027	-

The cost for 1930 shows an increase of \$.024 per ton. This is due to the use of larger and longer timber on sub levels and to the use of wire fencing for "covering" on sub levels. More lagging and poles were also used in this work to prevent rock runs and to increase safety.

Tramming

1930 Amount	\$50,549.11	Cost per ton	\$.087
1929 Amount	<u>56,003.59</u>	" " "	<u>.101</u>
Decrease	5,454.48	Decrease	.014

The decrease in expenditure is due to operating on a shorter working schedule since July 1st. The cost per ton is lower due to less expense for cleaning tracks on account of the new rocker dump cars purchased in 1930.

Ventilation

1930 Amount	\$4,878.91	Cost per ton	\$.008
1929 Amount	<u>4,084.02</u>	" " "	<u>.007</u>
Increase	794.89	Increase	.001

The increase in this account is due to running ventilation fan in No. 2 shaft on the night shift to improve ventilation.

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8. COST OF
OPERATING:

Pumping

1930 Amount	\$38,428.71	Cost per ton	\$.066
1929 Amount	<u>42,211.00</u>	" " "	<u>.076</u>
Decrease	3,782.29	Decrease	.010

	<u>1930</u>	<u>1929</u>
Total gallons of water pumped	557,227,893	648,316,346
Gallons pumped per minute	1,060	1,166

The decrease is due to less water pumped. There is a decrease of 91,088,453 gallons for the year, or 106 gallons per minute.

Compressors & Air Pipes

1930 Amount	\$42,835.32	Cost per ton	\$.074
1929 Amount	<u>46,422.67</u>	" " "	<u>.084</u>
Decrease	3,587.35	Decrease	.010

	<u>Compressors</u>	<u>Air Pipes</u>
1930	\$37,312.01	\$5,523.31
1929	<u>40,035.26</u>	<u>6,387.41</u>
Decrease	2,723.25	864.10

Total cu. ft. of air used in 1930	- 1,044,240,000
" " " " " " " 1929	- 1,123,840,000
Cubic feet per ton of ore - 1930	- 1,801
" " " " " " - 1929	- 2,022

The decrease in this account is due to less compressed air used. Expense for air pipes also decreased due to less extensions of air lines.

Back Filling

1930 Amount	\$1,941.35	Cost per ton	\$.003
1929 Amount	<u>4,959.80</u>	" " "	<u>.009</u>
Decrease	3,018.45	Decrease	.006

The decrease in this account is due to less filling broken on sub levels for mat. Less mining under new hanging in 1930.

Underground Superintendence

1930 Amount	\$15,634.88	Cost per ton	\$.027
1929 Amount	<u>14,172.30</u>	" " "	<u>.026</u>
Increase	1,462.58		.001

The increase is due to shift bosses' wages being figured on average wage earned by contracts under his supervision and also a bonus of 35¢ per day paid when no accidents occurred in each two-week period.

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YEAR 1930

8. COST OF
OPERATING:

Cave-In

1930 Amount	\$45.83	Cost per ton	\$.000
1929 Amount	<u>57.60</u>	" " "	<u>.000</u>
Decrease	11.77		

Very little change occurs in this account. The cost for fencing caved areas on surface was slightly less this year.

MAINTENANCE ACCOUNTS:

Compressors & Power Drills

1930 Amount	\$3,976.09	Cost per ton	\$.007
1929 Amount	<u>1,682.18</u>	" " "	<u>.003</u>
Increase	2,293.91	Increase	.004

	<u>Compressors</u>	<u>Power Drills</u>
1930	\$2,253.96	\$1,722.13
1929	<u>319.27</u>	<u>1,362.91</u>
Increase	1,934.69	359.22

The increase is due mainly to cost of installing feather valves, also new discharge valves, in the Nordberg compressor.

During the year 10 RB-12 Ingersoll Rand jackhammer drills, costing \$1700.00, were purchased, as compared with 8, costing \$1362.91, in 1929.

Hand Trammig Equipment

1930 Amount	\$00.00	Cost per ton	\$.000
1929 Amount	<u>81.19</u>	" " "	<u>.000</u>
Decrease	81.19		

This account shows no expenditures in 1930 due to all contracts using scraper hoist. The hand trammig equipment has all been removed from the mine.

Electric Tram Equipment

1930 Amount	\$22,076.90	Cost per ton	\$.038
1929 Amount	<u>15,599.06</u>	" " "	<u>.028</u>
Increase	6,477.84	Increase	.010

Sub Division

	<u>Gen. & Motors</u>	<u>Locomotives</u>	<u>Wiring</u>
1930	\$114.82	\$3,998.59	\$1,397.93
1929	<u>325.57</u>	<u>4,216.64</u>	<u>1,758.73</u>
Decrease	210.75	218.05	360.80

	<u>M. L. Tracks</u>	<u>M. L. Cars</u>
1930	\$5,606.25	\$10,959.31
1929	<u>5,672.14</u>	<u>3,625.98</u>
Decrease	65.89	Incr. 7,333.33

The increase in this account is due to charging out 18 new rocker dump motor cars. The old saddleback cars were scrapped this year and replaced with these new cars. All other divisions show a decrease this year.

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8. COST OF
OPERATING:

Pumping Machinery

1930 Amount	\$3,076.20	Cost per ton	\$.005
1929 Amount	<u>6,518.35</u>	" " "	<u>.012</u>
Decrease	3,442.15	Decrease	.007

The decrease in this account is due as follows:
\$1798.23 less for repairs to pumping machinery
\$1827.67 less for cutting sump on 12th level.

Total Underground Costs

1930 Amount	\$577,809.60	Cost per ton	\$.997
1929 Amount	<u>562,773.25</u>	" " "	<u>1.012</u>
Increase	15,036.35	Decrease	.015

SURFACE COSTS:

Hoisting

1930 Amount	\$29,589.78	Cost per ton	\$.051
1929 Amount	<u>30,608.67</u>	" " "	<u>.055</u>
Decrease	1,018.89	Decrease	.004

Electric Power 1930 -	\$22,315.30	Cost per ton	\$.0385
Electric Power 1929 -	<u>22,698.00</u>	" " "	<u>.0408</u>
Decrease	382.70	Decrease	.0023

The decrease in power cost is due to saving effected by new motor generator set installed in the engine house this year. The mine operated 23 days less in 1930 but the product increased 23,821 tons.

Stocking Ore

1930 Amount	\$6,921.62	Cost per ton	\$.012
1929 Amount	<u>5,029.58</u>	" " "	<u>.009</u>
Increase	1,892.04	Increase	.003

Tons stocked - 1930 -	265,149
Tons stocked - 1929 -	<u>181,321</u>
Increase	- 83,828

During 1930 additional rock trestle was erected on West end of steel trestle; this, with the additional tonnage stocked, accounts for the increase in expenditure.

Dry House

1930 Amount	\$9,119.26	Cost per ton	\$.016
1929 Amount	<u>8,625.97</u>	" " "	<u>.015</u>
Increase	493.29	Increase	.001

Coal to Boiler House:	<u>Tons</u>	<u>Cost</u>
1930	1,254	\$6,596.56
1929	<u>1,410</u>	<u>7,556.54</u>
Decrease	156	959.98

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8. COST OF
OPERATING:

Dry House (Cont)

Increase in this account is due to replacing a 50 h. p. boiler with a 125 h. p. boiler costing \$300.00 purchased from the Stephenson Mine.

A new hot well pump was installed in the heating plant and the necessary piping to drain the water from heaters in the mine buildings back to the hot well.

General Surface Expense

1930 Amount	\$7,154.97	Cost per ton	\$.012
1929 Amount	<u>6,717.29</u>	" " "	<u>.012</u>
Increase	437.68	Increase	.000

Increase in this account is due to extending the lawn area near the office building and repairing fences around mine grounds.

MAINTENANCE ACCOUNTS:

Hoisting Equipment

1930 Amount	\$8,965.20	Cost per ton	\$.016
1929 Amount	<u>9,283.16</u>	" " "	<u>.017</u>
Decrease	317.96	Decrease	.001

	<u>Sub Division</u>			
	<u>Sheaves</u>	<u>Wire Rope</u>	<u>Elec. Hoists</u>	<u>Skips & Skip Roads</u>
1930	\$564.51	\$1,672.91	\$1,711.98	\$5,015.80
1929	-	<u>1,045.84</u>	<u>5,185.31</u>	<u>3,013.28</u>
	564.51	627.07	3,473.33	2,002.52
	Incr.	Incr.	Decr.	Incr.

Sheaves: A new head sheave, costing \$493.55, was installed in February 1930, replacing one that was worn out.

Wire Rope: Two new ropes were put on the South skip hoist this year - one in January 1930, and the other in December 1930. A new rope was also placed on the North skip hoist in February 1930.

Electric Hoists: An armature costing \$3,117.18 was purchased in 1929 for the skip hoist. This explains the decrease in 1930.

Skips & Skip Roads: Increase in 1930 is due to more expense for repairs made to skip roads in shaft.

Shaft

1930 Amount	\$2,689.74	Cost per ton	\$.005
1929 Amount	<u>3,886.76</u>	" " "	<u>.007</u>
Decrease	1,197.02	Decrease	.002

Less repairs to shaft timber accounts for the decrease in 1930. In 1929 repair expense was high on account of accident of June 6th, when skip jumped the guides and damaged 200 ft. of the shaft.

NEGAUNEE MINE
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8. COST OF
OPERATING:

Top Tram Equipment

1930 Amount	\$3,095.29	Cost per ton	\$.005
1929 Amount	<u>1,783.67</u>	" " "	<u>.003</u>
Increase	1,311.62	Increase	.002

Sub Division

	<u>General Repairs</u>	<u>Wire Rope</u>
1930	\$2,043.48	\$1,051.81
1929	<u>1,406.54</u>	<u>377.15</u>
Increase	636.94	674.66

An armature on one of the 50 h. p. motors burned out in 1930 and was replaced; cost of armature was \$648.23.

A new wire rope was put on one side of the top tram system in December 1930.

Docks, Trestles & Pockets

1930 Amount	\$4,110.74	Cost per ton	\$.007
1929 Amount	<u>890.82</u>	" " "	<u>.002</u>
Increase	3,219.92	Increase	.005

Increase is due to grading new stocking ground Northeast of the shaft. The expense for grading, trestle work, and collar plank this year amounted to \$3,492.72.

Mine Buildings

1930 Amount	\$2,591.85	Cost per ton	\$.004
1929 Amount	<u>3,275.86</u>	" " "	<u>.006</u>
Decrease	684.01	Decrease	.002

	<u>1930</u>	<u>1929</u>	<u>Incr.</u>	<u>Decr.</u>
Office & Warehouse	234.32	362.72		128.40
Shops	129.44	8.35	121.09	
Shaft House	627.79	94.25	533.54	
Engine House	549.07	20.55	528.52	
Dry Houses	648.29	1939.51		1291.22
Coal Dock	91.63	66.36	25.27	
Miscellaneous	<u>311.31</u>	<u>784.12</u>		<u>472.81</u>
Total	2591.85	3275.86		684.01

Shop Building: Small repairs were made on these buildings in 1930.

Shaft House: The upper part of the shaft house enclosure near the skip dumps was enlarged in 1930, also the entrance to skip road at the collar of the shaft was enclosed to facilitate changing and repairing skip in severe cold weather.

Engine House: In 1930 the roof of this building was repaired, also floor in engine house was scraped and painted and new rubber matting laid.

Dry House: Expense for altering dry house to bring it up to standard was much less in 1930 as this work was practically completed in 1929.

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8. COST OF
OPERATING:

Total Surface Costs:

1930 Amount	\$74,238.45	Cost per ton	\$.128
1929 Amount	<u>69,451.35</u>	" " "	<u>.125</u>
Increase	4,787.10		.003

GENERAL MINE ACCOUNTS:

Insurance:

1930 Amount	\$54.86	Cost per ton	\$.000
1929 Amount	<u>66.73</u>	" " "	<u>.000</u>
Decrease	11.67		

Mining Engineering:

1930 Amount	\$2,533.09	Cost per ton	\$.004
1929 Amount	<u>2,134.03</u>	" " "	<u>.004</u>
Increase	399.06		

Increase is due to more time by engineers on surface surveys and on account of making new stocking ground, and measuring ore in stock on November 15th.

Mechanical & Electrical Engineering:

1930 Amount	\$2,704.46	Cost per ton	\$.005
1929 Amount	<u>2,057.98</u>	" " "	<u>.004</u>
Increase	646.48		.001

Increase is due to more time spent in 1930 on equipment by Mechanical and Electrical Dept. employees.

Analysis:

1930 Amount	\$12,657.31	Cost per ton	\$.022
1929 Amount	<u>14,039.37</u>	" " "	<u>.025</u>
Decrease	1,382.06		.003
Cost per determination in 1930	-	\$.1535	
Cost per determination in 1929	-	<u>.1339</u>	
Increase		.0196	

This account includes proportion of district laboratory expense and sampling.

	<u>Cost of Optg. Laboratory</u>	<u>No. Determinations</u>
1930	\$17,714.47	115,438
1929	<u>18,788.39</u>	<u>140,351</u>
Decrease	1,073.92	24,913

The number of determinations for the Negaunee Mine in 1930 was 38,972 as compared with 49,392 in 1929.

There were 24,913 fewer determinations made in the district laboratory for other mines. This increased the cost per determination though the total expenditure for the district laboratory is less.

Personal Injury Expense:

1930 Amount	\$17,759.21	Cost per ton	\$.032
1929 Amount	<u>17,361.38</u>	" " "	<u>.031</u>
Increase	397.83		.001

Increase is due to slightly larger payrolls this year, also to catastrophe insurance carried as additional insurance for the first year. The rate is .107 per \$100.00 payroll labor.

NEGAUNEE MINE
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8. COST OF
OPERATING:

Safety Department Expense:

1930 Amount	\$1,507.54	Cost per ton	\$.003
1929 Amount	<u>3,562.17</u>	" " "	<u>.006</u>
Decrease	2,054.63		.003

The cost for The C. C. I. Co. safety picnic was included in cost for 1929. This accounts for the decrease this year. The cost with this exception was about the same for both years.

Telephones & Safety Devices:

1930 Amount	\$2,763.46	Cost per ton	\$.005
1929 Amount	<u>2,617.30</u>	" " "	<u>.005</u>
Increase	146.16		

Increase in expenditure is for extension of lighting system on levels.

Local General Welfare:

1930 Amount	\$6,025.59	Cost per ton	\$.010
1929 Amount	<u>4,787.25</u>	" " "	<u>.009</u>
Increase	1,238.34		.001

Increase is due to more expense for local general welfare in 1930.

Special Expense:

1930 Amount	\$12,705.90	Cost per ton	\$.022
1929 Amount	<u>11,731.30</u>	" " "	<u>.021</u>
Increase	974.60		.001

Increase is due to change in method of distributing cost in 1930.

Ishpeming Office:

1930 Amount	\$17,583.24	Cost per ton	\$.030
1929 Amount	<u>19,172.99</u>	" " "	<u>.035</u>
Decrease	1,589.75		.005

Decrease is due to change in method of distributing cost in 1930.

Mine Office:

1930 Amount	\$13,805.44	Cost per ton	\$.024
1929 Amount	<u>15,696.05</u>	" " "	<u>.028</u>
Decrease	1,890.61		.004

	<u>Direct Charges</u>	<u>Mine Office</u>
1930	\$6,689.64	\$7,115.80
1929	<u>7,698.50</u>	<u>8,110.30</u>
Decrease	1,008.86	994.50

Decrease in direct charges due to difference in salary paid Asst. Supt. for five months and salary paid Efficiency Engineer for seven months. Mine Office decreased due to no expense for choreboy for Asst. Supt. after May 30th, and to Supt's choreman expense carried in Central Office account in 1930. Central Warehouse overhead decreased \$438.79 in 1930.

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8. COST OF
OPERATING:

Total General Mine Expenses

1930 Amount	\$90,100.10	Cost per ton	\$.155
1929 Amount	<u>93,554.79</u>	" " "	<u>.168</u>
Decrease	3,454.69	Decrease	.013

9. EXPLORATIONS
AND
FUTURE
EXPLORATIONS:

There were no explorations in 1930, nor is it expected there will be any for some time, as the limits of the Negaunee ore body, except for minor rolls in foot or hanging, are outlined above the 12th level.

10. TAXES:

A comparison of the taxes paid by the Negaunee Mine Company in 1930 and 1929 is as follows:

Description	1 9 3 0		1 9 2 9	
<u>City of Negaunee</u>	<u>Valuation</u>	<u>Taxes</u>	<u>Valuation</u>	<u>Taxes</u>
Realty - 213.19 acres	4,235,000	163,699.70	4,860,000	181,332.04
Personal-stockpile, equipt.	615,000	23,772.22	390,000	14,391.46
Total by Tax Commission	4,850,000	187,471.92	5,250,000	196,423.50
Collection Fees		1,874.72		1,964.24
Total Operating Negaunee Mine		189,346.64		198,387.74
Rented Buildings:				
C. C. I. Co. 1st Addition	34,400	1,329.85	34,600	1,294.64
Collection Fees		13.30		12.95
Total Negaunee Mine Co.	4,884,400	190,689.79	5,284,600	199,695.33
Tax Rate		3.8654		3.742
Total City of Negaunee Tax		611,259.85		600,686.18
Negaunee Mine % of City Tax		31.2%		33 $\frac{1}{4}$ %

The tax rate increased slightly in 1930, but total taxes decreased due to lower valuation on mine property. The amount of money raised for city purposes was the same in both years.

11. ACCIDENTS
AND
PERSONAL
INJURY:

The following table shows the classification of accidents for the years 1930, 1929, and 1928:

	<u>1930</u>	<u>1929</u>	<u>1928</u>
Fatal	1	1	1
Time lost - over four months	2	2	1
" " - one to four months	5	4	3
" " - less than one month	<u>3</u>	<u>2</u>	<u>12</u>
Total Accidents	11	9	17
Number of cases paid compensation for accidents prior to January 1, 1930	12	7	2
Number of cases being paid difference in wages	4	3	2

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11. ACCIDENTS
AND
PERSONAL
INJURY: (Cont)

The accidents causing loss of time of from one to four months consisted of one case each of torn ligament of knee, injury to nerve tissues of arm, abrasions to head, face, upper and lower extremities.

The accidents involving more than four months lost time were a fracture of the 3rd lumbar vertebrae, and the loss of left index finger.

A fatal accident occurred on June 20th at 9:30 A. M. in No. 35 contract on the 440' sub level, the second sub level above the 11th level on the North footwall. It caused the death of Eugene Laneville and buried his partner, John Herman, who was rescued about 12 o'clock; Laneville's body was recovered a short time later. Herman was suffering from shock and bruises but otherwise uninjured. They had put up the third set from the raise in the morning and were blocking it when a movement in the mat above caused the cap behind them to ride off the legs, letting the poles fall, also some dirt to run in from the side. Herman fell close to the breast and was partly protected by the poles, while Laneville was hit in the back of the head by the falling cap. The ground here is very heavy and although the adjoining slice had been blasted back to within three sets of the breast there was evidently some movement in the mat or sudden weight that caused the cap to move. Laneville was 45 years of age, a widower, and has one dependent son nearly 18 years of age.

12. NEW
CONSTRUCTION
AND
PROPOSED NEW
CONSTRUCTION:

(a) E. & A. #531 - Vacation of Maas, Lonstorf, and Mitchell Addition, and Healy Avenue Extension:

Estimate for moving houses, etc.		\$118,555.00
" " Healy Avenue Extension	\$14,000.00	
Less C. C. I. Co. proportion (62 $\frac{1}{2}$ %)	8,750.00	
Negaunee Mine proportion (37 $\frac{1}{2}$ %)		5,250.00
Total Estimate		\$123,805.00
Total expenditures to Jan. 1, 1930		133,192.75
" " in 1930		736.04
Unexpended balance Jan. 1, 1931		10,123.79 (red)
This E & A was completed in November 1930.		

E. & A. #557 - New Ilgner Hoisting Generator Set:

Total estimate		\$ 36,300.00
Total expenditures to Jan. 1, 1930		5,354.78
" " in 1930		34,122.18
Unexpended balance Jan. 1, 1931		3,176.96 (red)
This E & A was completed in August 1930.		

E. & A. #558 - Electric Haulage Generator Set:

Total estimate		\$ 7,467.00
Less sale of old set to Maas Mine		1,500.00
Total		5,967.00
Total expenditures to Jan. 1, 1930		5,899.14
" " in 1930		448.69
Unexpended balance Jan. 1, 1931		380.83 (red)
This E & A was completed in May 1930.		

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12. NEW
CONSTRUCTION
AND
PROPOSED NEW
CONSTRUCTION: (Cont)

E. & A. #574 - Rocker Dump Haulage Cars:

Total estimate - 36 cars @ \$485.00 each	\$ 17,480.00
Total expenditures in 1930	<u>17,480.00</u>
Unexpended balance Jan. 1, 1931	0.00
This E & A was completed in 1930.	

E. & A. #578 - Feather Valves for Nordberg Compressor:

Total estimate	\$ 900.00
Total expenditures in 1930	<u>1,490.12</u>
Unexpended balance Jan. 1, 1931	590.12 (red)
This E & A was completed in August 1930.	

13. EQUIPMENT
AND
PROPOSED
EQUIPMENT:

a. Steam Shovels:

Two of the Negaunee District shovels were repaired during the winter 1929-1930.

b. Stockpile Trestles:

(2) Wooden Trestle:

Four additional bents were erected on the West end of the rock trestle as compared with six in the previous year.

A new stocking trestle on the East side of the shaft was started in December. There will be approximately 200 ft. of permanent wooden trestle taking off to the Northeast from the permanent steel trestle about 200 ft. East of the shaft, and the new stocking trestle will run parallel to the steel trestle and 170 ft. to the North. There will be about 300 ft. of this stocking trestle put up in 1931 to take care of the production until shipping starts.

d. Scraper Hoists:

The mine is now supplied with the following scraper hoist equipment:

<u>Company</u>	<u>On Hand</u> <u>1/1/1930</u>	<u>Purchased</u> <u>1930</u>	<u>On Hand</u> <u>1/1/1931</u>
Ingersoll-Rand, air	12		12
Gardner-Denver, air	8		8
" " 7½ h.p. Electric	9	1 from Maas	10
" " 10 " "	2	1 " "	3
" " 15 " "	2		2
Sullivan, 6½ h.p. Electric	10		10
" 7½ " "	2 to Maas		0
" 10 " "	1 converted to 15 h.p.		0
" 15 " "	7	2	10
" 25 " "	3 1 to Maas		2
Ingersoll-Rand 15 h.p. Electric		4	4
Lake Shore Engine Works 25 h. p. scraper slide		1	1
Total	<u>56</u>	<u>7</u>	<u>62</u>

Distribution:- 5 on transfer subs, 1 on loader used in drifting, 56 in mining areas.

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13. EQUIPMENT
AND
PROPOSED
EQUIPMENT: (Cont)

e. Hoisting Equipment:

A new Ilgner flywheel set was installed in the addition to the engine house. This provides two of these sets that can be operated singly or together. The new set has a much larger capacity than the old set and made it possible to hoist a larger load in the skips.

The old skip armature that had caused some trouble was removed and a new armature installed. The old armature was repaired, then boxed to protect it from the weather, and stored near the engine house so it would be available in case of accident to the armature in use.

A new motor generator set was received in June and installed in the engine house. This is larger than either of the old sets at the mine. One of the old sets was then removed and sold to the Maas Mine. There is now ample direct current available for operating the underground haulage system and the 15 and 25 h. p. scraper hoists. There is sufficient excess direct current available to permit of completely equipping the mine with the larger h. p. scraper hoist units.

14. MAINTENANCE
AND REPAIRS:

A 125 h. p. boiler from the Stephenson Mine was installed in the boiler house, replacing the 50 h. p. boiler which was in bad condition. There are now two 125 h. p. boilers in the heating plant.

15. POWER:

Electric power was supplied during the year by the Cliffs Power & Light Company, a subsidiary of The Cleveland-Cliffs Iron Company. The rate charged for current was $1\frac{1}{2}$ per k. w. hour, the same as has been in effect for a number of years.

There were no serious delays due to lack of current.

17. CONDITION
OF
PREMISES

The lawn and planted areas at the mine were kept in good condition. An additional area was enclosed at the Northwest corner to square out the grounds. It was graded and seeded and shrubbery transplanted to the line of the new fence. The appearance of the mine premises has been materially improved and the entrance made more attractive.

18. NATIONALITY
OF
EMPLOYEES:

This report has been prepared under two statements. The first shows the nationality of the employees as to parentage; for instance, a man has been classified as a Finn when born in this country of Finnish parentage. This naturally shows only a few Americans employed. The second statement separates the nationalities into "Foreign born" and "American born".

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18. NATIONALITY
OF
EMPLOYEES: (Cont)

<u>As to parentage</u>	<u>1930</u>	<u>%</u>	<u>1929</u>	<u>%</u>
English	67	23	65	24
Finnish	117	40	96	36
Italian	35	12	35	13.5
Swedish	29	10	36	13
French Canadians	24	9	24	9
Americans (mixed)	-	-	-	-
Germans	3	1	3	1
Austrians	4	1	3	1
Norwegians	3	1	1	.5
Irish	4	1	3	1
Danish	7	2	4	1
Polish	1	-	-	-
	<u>294</u>	<u>100</u>	<u>270</u>	<u>100</u>

<u>As to birth</u>	<u>Total</u>		<u>American born</u>		<u>Foreign born</u>	
	<u>1930</u>	<u>1929</u>	<u>1930</u>	<u>1929</u>	<u>1930</u>	<u>1929</u>
English	67	65	33	33	34	32
Finnish	117	96	39	32	78	64
Italian	35	35	5	4	30	31
Swedish	29	36	12	15	17	21
French Canadians	24	24	20	18	4	6
Germans	3	3	1	2	2	1
Austrians	4	3	2	-	2	3
Norwegians	3	1	1	1	2	-
Irish	4	3	4	3	-	-
Danish	7	4	5	4	2	-
Polish	1	-	1	-	-	-
Total	<u>294</u>	<u>270</u>	<u>123</u>	<u>112</u>	<u>171</u>	<u>158</u>
Percentage			42%	41.5%	58%	58.5%

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1. GENERAL:

The mine operated on one 8-hour shift, six days per week, until the middle of July; for the balance of the year it operated five days per week.

The product in 1930 was the largest ever obtained in one year. The mine is in good condition for production but faces a heavy development program the latter part of 1931 when the 5th level ore body will be opened by drifts and raises.

Mining operations have been concentrated in two general areas, the foot-wall pillar, near the Negaunee boundary between the 3rd and 2nd levels, and an extensive area under the hanging above the 4th level. The ore body on the footwall of the Race Course was developed on the 3rd level and is now being opened for mining between the 3rd and 2nd levels. Production from the Race Course decreased nearly 30% in 1930 due to mining being stopped on sub level 44 ft. above the 4th level in order to protect the main level haulage drifts. Mining will be resumed here as soon as the 5th level is opened and raises put up, probably late in 1931.

Shipments decreased in 1931, and ore in stock increased 162,801 tons. Including overrun there were 403,000 tons in stock at the end of the year. Bessemer shipments must increase in 1931 as this grade is stocked from the steel trestle and must be shipped to make room for the product in the succeeding stocking season.

All the 4-ton saddleback underground tram cars were replaced in 1930 with 4-ton solid body rocker dump cars. The new cars eliminate spillage along the main haulage drifts, thereby improving haulage conditions and decreasing expense for cleaning tracks.

Additional 15 h. p. scraper hoist units were purchased in 1930, and purchases of these larger h. p. units must be continued until all the small electric and air units are replaced. It is difficult and in many cases impossible to complete the cycle with the small units, as it takes from three to six hours to scrape a cut to the raise, depending on length of haul, condition of scraper hoist, etc.

The grade of ore produced in 1930 showed an improvement as compared with the previous year. More careful covering down with poles and wire fencing is eliminating runs of rock from the back.

The average product exceeded the budget estimate. This was due to transfer of men from development work to ore production.

2. PRODUCTION,
SHIPMENTS &
INVENTORIES:

a. Production by Grades:

	<u>1930</u>	<u>1929</u>	<u>Increase</u>	<u>Decrease</u>
Maas Bessemer	123,308	107,005	16,303	
Race Course Bessemer	10,364	22,590		12,226
Maas	269,269	185,260	84,009	
Race Course	<u>13,712</u>	<u>17,067</u>		3,355
Total	416,653	331,922	84,731	
Rock	<u>26,840</u>	<u>15,028</u>	11,812	
Total	443,493	346,950	96,543	

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2. PRODUCTION,
SHIPMENTS &
INVENTORIES: (Cont)

b. Shipments:

<u>Grade of Ore</u>	<u>Pocket</u> <u>Tons</u>	<u>Stockpile</u> <u>Tons</u>	<u>Total</u> <u>Tons</u>	<u>Total</u> <u>Last Year</u>
Maas Bessemer	36,008	32,985	68,993	90,803
Maas	111,281	63,650	174,931	366,096
Race Course Bessemer	1,092	40	1,132	14,034
Race Course	5,744	3,052	8,796	8,879
Total	154,125	99,727	253,852	479,812
Total Last Year	200,550	279,262	479,812	
Decrease	46,425	179,535	225,960	

Shipments decreased 47% in 1930 and were 162,801 tons less than the product for the year.

c. Stockpile Inventories:

<u>Grade of Ore</u>	<u>Dec. 31, 1930</u>	<u>Dec. 31, 1929</u>	<u>Increase</u>	<u>Decrease</u>
Maas Bessemer	76,769	22,454	54,315	
Maas Ore	158,012	63,674	94,338	
Race Course Bessemer	17,788	8,556	9,232	
Race Course	13,176	8,260	4,916	
Total	265,745	102,944	162,801	

Including overrun in stockpile, accumulated over a long period, there were over 400,000 tons in stock at the end of the year.

d. Division of Product by Levels:

	<u>1930</u>	<u>%</u>	<u>1929</u>	<u>%</u>
2nd Level	0		74,434	22.4
3rd Level	116,252	27.5	27,484	8.3
4th Level	300,401	72.5	230,004	69.3
Total	416,653	100.0	331,922	100.0

Production from the footwall pillar between the 3rd and 2nd levels increased in 1930, also the product from subs above the 4th level.

e. Production by Months:

The production by months is as follows:

<u>Month</u>	<u>Maas Bess.</u>	<u>Maas</u>	<u>R.C. Bess</u>	<u>Race Course</u>	<u>Total</u>	<u>Rock</u>
January	10,504	19,724	932	880	32,040	1,844
February	9,676	16,952	2,068	1,240	29,936	1,700
March	12,656	17,860	888	800	32,204	1,936
April	11,952	20,512	912	710	34,086	2,016
May	12,847	25,864	794	2,300	41,805	1,752
June	11,667	26,484	247	555	38,953	1,604
July	10,188	24,701	368	1,523	36,780	1,492
August	8,671	23,166	1,017	1,378	34,232	1,540
September	8,400	24,930	981	1,512	35,823	3,340
October	9,400	23,985	964	703	35,052	3,080
November	8,818	19,764	676	428	29,686	3,256
December	10,152	23,704	964	1,236	36,056	3,280
Total	124,931	267,646	10,811	13,265	416,653	26,840

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2. PRODUCTION,
SHIPMENTS &
INVENTORIES:

(Cont)

e. Production by Months: (Cont)

	<u>Maas Bess.</u>	<u>Maas</u>	<u>R.C.Bess</u>	<u>Race Course</u>	<u>Total</u>	<u>Rock</u>
Brot Ford	124,931	267,646	10,811	13,265	416,653	26,840
Transferred from	1,623	to 1,623	447	to 447		
Stockpile Overrun	0	0	0	0	0	
Total	123,308	269,269	10,364	13,712	416,653	26,840
Total 1929	107,005	185,260	22,590	17,067	331,922	15,028
Increase	16,303	84,009			84,731	11,812
Decrease			12,226	3,355		

The product was distributed as follows:

	<u>1930</u>	<u>1929</u>	<u>Increase</u>	<u>Decrease</u>
George Maas Lease	300,777	214,053	86,724	
Catholic Cemetery	54,484	49,620	4,864	
C. C. I. Co. (Right of way)	20,500	9,332	11,168	
American Mining Company	7,484	4,568	2,916	
Race Course	24,064	39,657		15,593
City of Negaunee	9,344	14,692		5,348
Total	416,653	331,922	84,731	

f. Ore Statement:

	<u>Maas Bessemer</u>	<u>Maas</u>	<u>R.C. Bess</u>	<u>Race Course</u>	<u>Total</u>	<u>Total Last Year</u>
On Hand Jan. 1, 1930	22,454	63,674	8,556	8,260	102,944	250,834
Product for Year	124,931	267,646	10,811	13,265	416,653	331,922
Overrun	-	-	-	-	-	-
Transferred from	1,623	to 1,623	447	to 447		
Total	145,762	332,943	18,920	21,972	519,597	582,756
Shipments	68,993	174,931	1,132	8,796	253,852	479,812
Balance on Hand	76,769	158,012	17,788	13,176	265,745	102,944
Increase in Output					84,731	
Increase in ore on hand					162,801	

1930 - 1 8-hour shift, 6 days per week, January 1st to July 16th
 5 " " " July 16th to December 31st
 1929 - 1 8-hour shift, 5 " " " January 1st to April 15th
 6 " " " April 15th to December 31st

g. Delays:

March 21st - 3 days delay due to breaking of the South skip rope
 April 2nd - 2 hrs. " " " jackpot at 109 Raise on 3rd level
 May 16th - 1 " " " skip hoist brake out of order
 " 26th - 4 " " " counterweight for cage stuck in pipe
 June 19th - 2 " " " collision of motor trains on 4th level
 " 20th - 2 " " " trouble with measuring pocket doors
 " 26th - 5 " " " broken shaft runner
 Sept. 19th - 4 " " " skip getting off runners

h. Delays from Lack of Current:

July 17th - 1 $\frac{1}{4}$ hours on account of lack of current.

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3. ANALYSIS:a. Average Mine Analysis on Output for 1930:

<u>Grade</u>	<u>Iron</u>	<u>Phos.</u>	<u>Silica</u>
Maas Bessemer	61.38	.044	7.45
Maas	60.01	.066	8.11
Race Course Bessemer	61.38	.044	7.25
Race Course	59.36	.061	8.82

The grade of ore produced in 1930 was slightly better than in 1929.

b. Average Analysis on Straight Cargoes:

<u>Grade</u>	<u>Mine</u>		<u>Lake Erie</u>	
	<u>Iron</u>	<u>Phos.</u>	<u>Iron</u>	<u>Moist</u>
Maas Bessemer	-	-	-	-
Maas	59.96	.066	60.06	11.17
Race Course Bessemer	-	-	-	-
Race Course	-	-	-	-

The grade of ore shipped as a straight cargo was higher in 1930.

c. High Sulphur Ore:

There was no high sulphur ore encountered during the year.

4. ESTIMATE OF
ORE RESERVES:a. Developed Ore:

Assumption: 12 cubic feet equals one ton
10% deducted for rock
10% deducted for loss in mining
Percentage of Bessemer equals 10.

Between 2nd and 3rd levels	1,140,600 tons
Between 3rd and 4th levels	<u>3,510,762 "</u>
Total	4,651,362 "

This includes the ore in the Race Course Lease to the 4th level only, while estimate of Dec. 31, 1929, included 1,500,000 tons of ore mostly below the 4th and totaled 5,975,050 tons. The decrease is due to the decision to only show as developed ore the ore above the 4th level.

b. Prospective Ore:

There is no prospective ore shown in this report. All the ore below the 4th level is prospective ore and will be included as developed ore when the 5th level is opened and the ore body developed by drifts and raises.

c. Estimated Analysis:

Ore Reserves: Approximate Expected Natural Analysis.

	<u>Iron</u>	<u>Phos.</u>	<u>Silica</u>	<u>Mang.</u>	<u>Alum</u>	<u>Lime</u>	<u>Mag.</u>	<u>Sul.</u>	<u>Igni</u>	<u>Moist</u>
Maas & R. C.										
Bessemer	53.50	.040	6.40	.195	2.00	.80	.225	.008	1.10	12.00
Maas & Race										
Course	52.45	.060	6.63	.208	2.20	1.10	.320	.010	1.80	12.50

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4. ESTIMATE OF
ORE RESERVES: (Cont)

c. Estimated Natural Analysis: (Cont)

Ore in Stock:	Average Natural Analysis:									
	Iron	Phos.	Silica	Mang.	Alum	Lime	Mag.	Sul.	Igni	Moist
Maas Bessemer	54.12	.039	6.34	.194	2.02	.88	.224	.008	.98	11.50
Maas	52.67	.075	7.00	.200	2.10	1.20	.350	.011	1.80	11.75
R.C.Bessemer	53.85	.040	6.35	.180	2.00	.75	.220	.009	1.00	11.50
Race Course	52.60	.058	7.70	.183	2.20	1.00	.250	.010	1.70	11.75

5. LABOR AND WAGES:

a. Comments:

(1) Labor:

There was no shortage of surface or underground men during the year.
The wage scale was the same as last year.

(2) New Construction:

The following is a list of the E. & A's on which work was done during 1930:

- E. & A. #513 - Moving 44 Maas Houses
- E. & A. #531 - Healy Avenue Extension - C. C. I. Co. 62½%
- Negaunee Mine Co. 37½%
- E. & A. #533 - Painting 30 Houses and Sheds
- E. & A. #548 - Sinking Maas Shaft and Developing 5th Level.
- E. & A. #559 - Electric Haulage Generator Set.

All E. & A's will be taken up in detail under #12 "New Construction and Proposed New Construction".

b. Comparative Statement of Wages and Product:

	1930	1929	Increase	Decrease
PRODUCT	416,653	331,922	74,731	
No. Shifts and Hours	1-8 hr	1-8 hr		
<u>AVERAGE NO. MEN WORKING:</u>				
Surface	42½	43		½
Underground	191	165	26	
Total	233½	208	25½	
<u>AVERAGE WAGES PER DAY:</u>				
Surface	4.47	4.37	.10	
Underground	5.25	5.07	.18	
Total	5.10	4.92	.18	
<u>WAGES PER MONTH OF 25 DAYS:</u>				
Surface	111.75	109.25	2.50	
Underground	131.25	126.75	4.50	
Total	127.50	123.00	4.50	
<u>PRODUCT PER MAN PER DAY:</u>				
Surface	30.82	25.26	5.56	
Underground	7.64	6.77	.87	
Total	6.12	5.34	.78	

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5. LABOR AND WAGES:b. Comparative Statement of Wages and Product: (Cont)

	<u>1930</u>	<u>1929</u>	<u>Increase</u>	<u>Decrease</u>
<u>LABOR COST PER TON:</u>				
Surface	.145	.173	.028	
Underground	.687	.748	.061	
Total	.832	.921	.089	
<u>AVERAGE PRODUCT MINING:</u>				
Stoping	20.45	16.85	3.60	
Ore Development	7.28	7.62		.34
Total	18.79	15.23	3.90	
AVERAGE WAGES CONT. LABOR	5.80	5.42	.38	
<u>TOTAL NUMBER OF DAYS:</u>				
Surface	13,520	13,140	380	
Underground	54,541	49,006	5,535	
Total	68,061	62,146	5,915	
<u>AMOUNT FOR LABOR:</u>				
Surface	60,434.02	57,401.76	3,032.26	
Underground	286,125.80	248,243.64	37,882.16	
Total	346,559.82	305,645.40	40,914.42	

Proportion of Surface to Underground Men:

1930 - 1 to 4.49	One 8-hr shift, 6 days per week,	January 1st to July 16th
1929 - 1 to 3.84	" " " 5 " " "	July 16th to Dec. 31st
1928 - 1 to 4.11	" " " 6 " " "	January 1st to Apr. 15th
1927 - 1 to 4.32	" " " 5 " " "	April 15th to Dec. 31st
1926 - 1 to 3.87	" " " 5 " " "	

6. SURFACE:a. Buildings, Repairs:

The warehouse and office building was repaired during the year. The old hardwood floor that had rotted, as also the underfloor of rough lumber, was removed, new joists installed where necessary, foundation repaired, after which a new floor was laid. The steam lines under the building were repaired and covered with asbestos pipe covering. A rough floor was installed in the loft of the warehouse to provide additional room for storage of supplies. The work of painting the office, captain's change room, etc. was underway the last of the year. As a result of the work done this year, the Maas office is now in first class condition and compares very favorably with the offices at the other company mines.

Work was started in the dry house in 1929 to change the arrangement for drying clothes to the standard that has been adopted by the company. This work was continued in 1930 and completed in February. The clothes are now hung on hooks attached to chains and are hoisted to the upper part of the building for drying. The old clothes racks, hoods, etc. have been removed, which permitted the adding of a number of new benches.

The roof of the dry was being repaired the latter part of the year as the asbestos roofing had loosened in the joints where it was nailed. 6" strips were put over these joints, securely nailed, and cemented. When this work is completed next Spring the roof will be given a treatment with a filler coat to be followed by an application of asbestos roof cement.

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6. SURFACE: (Cont)

a. Buildings, Repairs: (Cont)

The old horse shed was converted into a garage. A concrete floor was installed, the walls gunited, and steam heat installed. The mine truck and tractor are kept in this building.

The Maas Mine launder which carries the mine water across the fields to the Northwest of the mine was repaired in a number of places where the planks had rotted. It is planned to replace this launder within a year or so with an underground 18" sewer line as it passes through the area that has been set aside for The C. C. I. Co. 2nd Addition to the City of Negaunee.

The tool shed which has been located on the lawn East of the shops was moved to the North and located just East of the garage building.

The storage sheds and garage were painted in the Fall, as also the exterior of the mine office building.

At the end of the year the work of enclosing the entrance to the skip roads at the collar of the shaft was under way. This work is being done in order to protect the men that inspect and repair the skips during severe cold weather.

b. Stockpiles:

The rock trestle to the East of the shaft was extended 120 ft., five double bents being added, making 16 wooden bents in all that extend East from the end of the steel stocking trestle. Considerable repairs to the rock trestle were necessary during the year in order to keep it in shape and lined up with the steel trestle.

A total of 34 bents were put up on the West side of the shaft for stocking Maas Ore. This was a longer trestle than it has been necessary to erect in former years because stocking started this year in August and approximately 68,000 tons were stocked before the shipping season closed. The ore stocked in the winter of 1929-30 was not shipped last summer so it was necessary to erect a trestle in an open area to the South of the previous year's stockpile.

c. Tracks, Roads, etc.

A parking ground for cars was made in the field immediately West of the mine grounds. The ground was levelled with cinders. The number of cars used by employees in going to and from work has increased very rapidly in the last two years and it has been necessary to provide parking areas at each of the mines.

7. UNDERGROUND:

a. Shaft Sinking:

The sinking of the shaft to the 5th level, started in September 1929, continued until the early part of July on the night shift from 11 P. M. to 7 A. M. when the shaft was bottomed 4 ft. below the 6th level. While sinking was in progress the 5th level storage and measuring pockets were excavated and concreted. During July and the first week of August the 6th level was opened up for a skip pit level and a skip pit pocket was built. The distance from the 4th to the 5th is 127 ft., and from the 5th to the 6th, 102 ft. The material was all quartzite. The progress of sinking was as follows:

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7. UNDERGROUND:a. Shaft Sinking: (Cont)

January	9'	Hard ground and cutting pocket	5th level
February	10'	" " " " " "	" "
March	8'	" " " " " "	" "
April	8'	" " " " " "	" "
May	30'	" "	
June	27'	" "	
July	7'	Sinking one week in July	
Total	99'		
Sunk in '29	56'		
Total ft.sunk	155'		

Drifting on the 5th level started August 18th.

b. Development:

The development work in 1930 consisted of drifting on the 2nd, 3rd, 4th, and 5th levels and raising on the 3rd and 4th levels.

2nd Level:

The new drainage and ventilation drift in the footwall near the Western boundary of the Roman Catholic Cemetery, started last year, advanced 35' in jasper and holed to the old footwall drift. An old connection from the footwall drift to the second footwall drift was reopened and timbered, after which the second footwall drift was driven 75' East and holed to the Negaunee Mine. This provided a permanent connection in rock from the Maas to Negaunee shafts, and also improved ventilation in both properties.

3rd Level:

In the footwall pillar near the Negaunee boundary the only development work has been raising, which was continued through the year. Seven raises were completed to the working subs above the 465' sub, the total footage raised was 68' of rock and 820' of ore.

There has been considerable development work done in the ore body lying West of the dike at the South extension of the shaft crosscut. In 1929 a small ore body was found on the 4th level in the Race Course tract North-west of the dike on the North footwall. This same ore body was developed on and above the 3rd level during 1930. An area 80 ft. North and South by 300 ft. East and West has been proven up on the 3rd level and the top of the ore body at the East end has been found 100 ft. above the 3rd. At the end of the year a drift was being driven near the footwall on the 3rd level to find the western end. Four raises have been put up in this area through 270 ft. of ore and 70 ft. of rock. There was 110 ft. of rock drift and 432 ft. of ore drift on the 3rd level. This area will be taken up in detail under stoping.

4th Level:

The crosscut 150 ft. East of the main haulage crosscut from the shaft, started last year, was completed in the early part of this year by drifting 265 ft. in ore between the footwall drift and the so-called "400 drift".

The North footwall drift was extended in the Race Course around the curve to the Southeast 80 ft. to the dike. This drift was in the ore body North-west of the dike which was developed this year on and above the 3rd level. One raise, #303, was put up here to the 260 ft. sub, a crosscut driven 60' to the North to the footwall, and a footwall raise put up to the 3rd level. The raises passed through 50 ft. of rock and 170 ft. of ore.

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7. UNDERGROUND:b. Development: (Cont)4th Level: (Cont)

In the drift parallel to the Negaunee boundary eight raises were completed, all in ore, total raising 818 ft. They were extended up to the elevation of the 200' sub level, 97 ft. above the 4th level.

There was an average of seven contracts on development work in 1930 above the 4th level, as compared with nine in 1929.

5th Level:

Drifting on this level started on August 18, 1930. The North tail track crosscut was extended 120 ft. North of the shaft and the last 15 ft. was widened and a motor repair pit excavated. The pumphouse to the East of the shaft was excavated and the sump drift started at a point 240 ft. South of the shaft. The South crosscut to the ore body had reached a point 724 ft. South of the shaft December 31st. All drifting on the 5th level has been in hard quartzite except the last 100 ft. in the main drift to ore body, which was in hard grey slate. The quartzite is very hard to drill and it has been difficult to provide sufficient steel due to breakage. It is expected that the ore body will be reached about June 1st, 1931, when another contract will be added and a Southwest footwall drift and two crosscuts in the Race Course started. They will be pushed as rapidly as possible so that raises can be put up to the 4th level and mining resumed along the Eastern boundary of the Race Course where it has been temporarily stopped, as the last sub level mined in this area is only 44 ft. above the 4th level. Mining at lower elevations here would cause the 4th level haulage drifts to crush.

The following table shows the amount of drifting and raising on the various levels:

	Drifting		Raising		Total	Total
	Ore	Rock	Ore	Rock	1930	1929
2nd Level	-	120'	-	-	120'	260'
3rd Level	432'	130'	1,090'	138'	1,790'	1,009'
465' Transfer	-	425'	-	-	425'	-
4th Level	345'	20'	938'	-	1,303'	3,290'
5th Level		838'*	-	-	838'	-
Total	777'	1,533'	2,028'	138'	4,475'	4,559'

* Rock drifting on 5th level is exclusive of pumphouse and sump.

c. Stoping:(1) General Remarks:

Mining operations during the past year have been confined to the footwall pillar above the 3rd level near the Negaunee boundary, to development work in the Western end of the 3rd level, and to the subs above the 4th level in the areas along the Eastern boundary of the Race Course and South to the Negaunee boundary. The 2nd level, and the 495', or first sub below, have been mined out in the footwall pillar above the 3rd level near the Negaunee boundary. The transfer system installed here last year on the 465' sub level has been abandoned as all the raises have been completed and the contracts now dump directly to the 3rd level. This area is very heavy and parts of it are quite wet which has made it necessary to do an unusual amount of repair work to keep the raises and drifts open.

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7. UNDERGROUND:

c. Stoping: (Cont)

(1) General Remarks: (Cont)

A drift was driven in the footwall on the 465 ft. sub from the foot of the winze from the 2nd level for handling timber and other supplies to the operating sub levels in this area.

An average of four contracts have worked during the year in the Western part of the 3rd level. Four raises were put up and connections made on the 355' sub, 50 ft. above the 3rd level, and the footwall and hanging outlined, showing the ore body to be approximately 50 ft. wide x 300 ft. long on the 355' sub. Three of the raises have been extended to a point 100 ft. above the 3rd level where hanging was encountered. At the end of the year mining was in progress from two of these raises.

A footwall drift is now being driven in ore on the 3rd level to find the Western limits of this ore body.

On the 4th level where most of the contracts have been employed, mining conditions have been excellent. It has been necessary to use a large quantity of poles, lagging, and wire fencing in this territory to form a mat under new hanging and old workings where the mat had rotted.

There have been an average of 39 contracts stoping during 1930 with three on double shift as compared with 34 contracts, none on double shift, in 1929.

During the year ore has been mined on all the leases, Maas Lease, Roman Catholic Cemetery Lease, City of Negaunee Lease, American Mining Co. right-of-way, C. C. I. Co. right-of-way, and Race Course.

The detail of mining on the various levels and sub levels is as follows:

2nd Level:

In 1929 a new footwall drift was started near the East end of the 2nd level and was driven to provide a permanent connection to the Negaunee Mine in rock for second outlet and to improve ventilation, also to provide drainage for the water that came down on the North footwall. This drift was nearly completed in 1929. It advanced 40 ft. in 1930, after which ditches were dug for drainage and timber in the old drifts repaired. Later in the year the second footwall drift was extended to the East 80 ft. and holed to the 10th level Negaunee.

Mining on the 2nd level was completed in August 1930. Most of the mining this year was in the Roman Catholic Cemetery area. A small area was also mined in the railroad pillar, on the Maas Lease, and along the West boundary of the Cemetery tract.

Subs above the 3rd Level:

495' Sub Level:

This sub level was opened in January 1929 and at the end of 1930 was practically mined out. One small pillar remains to be mined in the cemetery area and one contract was working here in December.

A pillar, of which only a small part is ore, has been left on the footwall near the West boundary of the cemetery tract and will be left on subs below to hold back the water that otherwise would prove a serious source of trouble. This water comes in on the North footwall and the small ore and rock pillar that is left here to keep it out of the sub levels will improve working conditions on all the sub levels below.

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7. UNDERGROUND:

c. Stoping: (Cont)

485' Sub Level:

Work was started at the West end of the footwall pillar in November 1929 and at the end of 1930 there was still some ore to be mined here in the Roman Catholic Cemetery and near the West boundary of this tract. During 1930 the ore was mined in the railroad pillar and in the West end of the pillar on the Maas Lease. Four contracts were mining in the cemetery tract in December.

475' Sub Level:

Work was started on this sub level in September 1930 and mining at the end of the year was being done in the area near the West end of the pillar and in the railroad pillar on the Negaunee boundary. Work has not yet started in the Roman Catholic Cemetery area. Four contracts were working on this sub in December.

465' Sub Level:

This sub level was opened in 1929 to provide means for handling timber for the sub levels between this elevation and the 2nd level. One drift on this sub level was used part of the year as a transfer for an area in the Roman Catholic cemetery. Because of excessive pressure and movement of ground near the hanging it became impossible to maintain the drifts in ore which were used for handling timber and supplies, and during 1930 a rock drift was driven in the footwall through which the timber and other supplies are now handled. Near the East end of the pillar in the cemetery tract, Nos. 118 to 122 raises, inclusive, have lately been connected by a new drift in ore. Drifts driven on the strike of the formation are subject to much more weight than the crosscuts, so, as far as possible, connections to the raises will be made by crosscuts from the rock drift in the footwall.

The transfer system which has been used here during the most of the past year was replaced by raises from the 3rd level and was recently abandoned.

The East end of the 465 ft. sub connects to a raise in the Negaunee Mine which insures good ventilation in the sub levels now being mined in this area.

At the end of the year one contract was driving a crosscut in ore from 119 raise to make a connection to the rock drift in the footwall.

404' Sub Level:

This sub level has been opened in the upward extension of the Race Course footwall ore body almost directly South of the shaft. It is approximately 100 ft. above the 3rd level and shows the ore at this point to be 17 ft. wide from the hanging to the footwall. The work here is largely exploratory at this time and is being done to locate the top of the ore body. The ore coming from this sub level has to be transferred on a lower sub level as the raise to the 404' sub level starts on the footwall side of the 355' sub. One contract was working here in December.

385' Sub Level:

This sub level has been opened under the hanging near the East limits of the ore body which has been designated the ore body on footwall of Race Course. The hanging at this sub level is approximately 100 ft. above the 3rd level although the floor of the sub is only 85 ft. above it. There are apparently several rolls in the hanging that carry the ore to different elevations. This sub level has been opened in the most Easterly of these rolls and from the work done during December it is evident that the area

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7. UNDERGROUND:

c. Stoping: (Cont)

385' Sub Level: (Cont)

here will be quite small, probably not over 30 x 30 ft. in size. This sub level was developed by a raise put up from the 355 ft. sub, a direct connection to the 3rd level being made later by a raise which holed to the bottom of the raise to this sub.

Another raise further West in the Race Course has reached this elevation and has been cut out preparatory to drifting, but no further work will be done here until additional information is gained of the ore body on the 3rd level.

355' Sub Level:

This sub level was opened 50 ft. above the 4th in the ore body on the footwall of the Race Course. This ore body lies West of the old mined area and is partly in the Race Course and partly East of the Race Course. Four raises have been put up to this sub from the 3rd level and three of them have been connected by a drift in ore. At one of these raises a crosscut has been driven to the foot where the ore was found to have a width of 70 ft. The ore in this drift was unusually hard to drill and break, as it required over 40 holes to break a cut. The ore is not hard but it is extremely tough and compact. No definite idea of the extent of the ore body at the elevation of this sub level will be obtained until further development takes place. At the North end of the crosscut referred to above a raise was put up starting on the foot, which encountered the hanging, and was cut out at an elevation of 404 ft., or 100 ft. above the 3rd level. There was no work being done on the 355' sub level at the end of the year.

3rd Level:

In order to develop the ore that had been found near the footwall of the Race Course ore body on the 4th level it was decided to extend the main crosscut from the shaft on the 3rd level to the South and crosscut the ore and then follow it to its Western limit. Accordingly, a drift was started in March which after passing through 70 ft. of rock struck ore which proved to be 82 ft. in width before striking dike which forms the South boundary of the ore. A drift was then started to the West a short distance North of the footwall contact. After passing through 80 ft. of rock the drift struck ore and continued in ore a distance of 165 ft. to the West where it encountered the jasper hanging. A few feet ~~back~~ back of the breast a crosscut was driven to the North to locate the footwall which was found 50 ft. North of the main drift. The West drift was then turned in a North-westerly direction where it was being driven at the end of the year in ore. It will be continued until it intersects the foot and will then turn West and follow it to the limit of the ore body. One contract on double shift was driving this drift at the end of the year.

Subs above the 4th Level:

240-230-215' Sub Levels:

A small roll in the hanging near the South boundary of the Race Course that was first discovered on the 195 ft. sub in 1929 was mined out on the 240-230 and 215 ft. sub levels during the year. Work has been carried on here by two contracts on double shift in order to mine this area down to the elevation of surrounding sub levels. The ore in this roll is approximately 100 x 100 ft. in size.

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7. UNDERGROUND:

c. Stoping: (Cont)

200' Sub Level:

Mining was continued during the year in the area adjacent to the Negaunee boundary and South and East of the Race Course. This area is about 400 ft. in length by 140 ft. in width. It had been mined out on a number of sub levels in previous years. The floor covering of the last sub mined had rotted and it was necessary to forepole over the entire area. Three contracts were mining the last pillars left in this area at the end of the year.

Mining was nearly completed the last of the year in the roll in the hanging at the elevation of this sub level located near the South boundary of the Race Course. Two gangs, both double shift, were working here at the end of the year.

195' Sub Level:

Mining operations on this sub level during the past year have been located partly on the Maas Lease near the Southeast corner of the Race Course, partly in the area adjacent to the Negaunee boundary, and partly in the railroad pillar. Mining of the various areas noted above had been completed at the end of the year except in that part of the area near the Negaunee boundary that has been mined out this year on the 200' sub. Six contracts were working this sub level in December.

185' Sub Level:

Mining was done in this sub level during the year in the area immediately South and East of the Race Course. Near the end of the year stoping started above the 600 series of raises near the Negaunee boundary. Near 617 raise at the elevation of this sub level there is a dike a few feet South of the raise. An exploratory drift was driven through this dike in a Southeasterly direction into the railroad pillar but no ore was found. Seven contracts were slicing on this sub level in December, four working near the Negaunee boundary, and three in the area Southeast of the Race Course.

170' Sub Level:

Mining was started under the hanging in the Race Course and in the territory immediately East of the Race Course late in 1928 and was practically completed in this area in October 1929. During the present year additional territory became available for mining immediately South and East of the Southeast corner of the Race Course due to completion of mining operations above this area. Four contracts were mining here during December.

This sub level is the first one on which the ore body on the Race Course begins to get larger in size. In addition to the ore along the East boundary of the Race Course, ore has come in under the hanging at the Southeast corner and for some distance to the West.

160' Sub Level:

Stoping to the available mining limit established East of the Race Course was started in January 1929 and completed in August 1930. The ore extended further to the West on the Race Course on this sub level due to the Westerly dip of the hanging wall. In December work was again started on this sub level and three contracts started working under the hanging near the South boundary of the Race Course.

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7. UNDERGROUND:

c. Stoping: (Cont)

150' Sub Level:

This sub level was opened in the area adjacent to the Race Course East boundary in August 1929 and mining was still in progress here at the end of 1930. At the end of the year two contracts were working in the Race Course and two in the Maas Lease. Mining is practically completed on the Race Course along the East boundary.

It is not planned to do any further mining in this block as the next sub level would be so close to the 4th level haulage drift as to cause it to crush. Mining will be resumed here just as soon as raises have been put up to this elevation from the 5th level.

4th Level:

Development work was continued on the 4th level through the greater part of the past year.

No. 3 crosscut West was continued through ore a distance of 83 ft. to the dike. It did not seem probable that any ore would be encountered to the South of this dike so work was discontinued. No. 3 crosscut East was driven from a point near the North or footwall drift until it cut the "400" drift a distance of 265 ft. South. This new crosscut will become the main haulage drift to the shaft as soon as mining starts above the present crosscut, which can then be kept open no longer. Mining will be started here late in 1931 following the completion of raises to this area from the 5th level. During the year nine raises were put up from the 4th level to the elevation of the 200 ft. sub.

5th Level:

Work started on the 5th level plat in December 1929. Sufficient ground was removed so drifting could be started here later, after which sinking was resumed, the pocket excavated and sinking completed to a point 3 ft. below the 6th level in the early part of July. Drifting started on the 5th level August 18th and was continued to the end of the year, by which time the main haulage drift to the South was in a distance of 724 ft. from the shaft. The tail room drift North of the shaft was driven a distance of 120 ft., the last 15 ft. of this drift was widened out and excavated for a motor repair pit. Ground was excavated for pumphouse East of the shaft and this work was nearly completed at the end of the year. A stub drift was started at a point 250' South of the shaft, that will later be extended for the sump.

The ground encountered on the 5th level has been a very hard, dense quartzite for a distance of 650 ft., when hard grey slate was encountered. It has been difficult to keep sufficient drill steel available for this work. The formation dips to the South at an angle of 45° and the quartzite varies in hardness. The drills tend to follow the softer seams and bind, with a consequent high breakage of the shanks on the drill steel. A crew of six men and a boss have worked here day shift, with a crew of three men night shift. Since slate was encountered more rapid progress has been made and it is hoped to obtain an advance of 250 ft. per month on the five day a week schedule in the slates, which will grow softer as the drift approaches the ore body. A permanent ditch has been excavated as the drift advanced so as to have this work completed by the time the drift reaches the ore. There is another advantage, namely, that the permanent air lines can be installed with no danger of breakage as the drift advances. Permanent haulage tracks are also being installed on the 5th level. On account of the large available tonnage and long haul, 50 lb. rail is being used here.

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7. UNDERGROUND:c. Stoping: (Cont)5th Level: (Cont)

It is planned to complete in 1931 the excavation of pumphouse and sump and install permanent discharge line in shaft from the 5th to 3rd levels, where the main pumping plant is located.

The Conway loader has been used for loading rock in the drift and when it is out of order a Lake Shore incline slide and scraper hoist has been used. The Conway loader has not proven very satisfactory. It loads material quite rapidly but there has been constant delay due to breakage. The machine was not built at the regular manufacturing plant where most of the Conway shovels are made but was built on a sub contract let to a firm in Chicago.

Two contracts were working on the 5th level day shift in December and one contract night shift.

d. Timbering:

The cost for timber in 1930 decreased due to less ore raising and less timber used repairing drifts and raises. The ore product increased 84,731 tons, but due to decrease in feet of timber per ton of ore the actual amount of timber used only increased slightly. The decrease in cost per ton amounts to over 21% and is partly due to use of 9 ft. legs in the sub levels, which increased production per set of timber.

Statement of Timber Used:

	LINEAR FEET	AVG. PRICE PER FOOT	AMOUNT 1930	AMOUNT 1929
6 to 8" Timber	98,903	.050	4,960.54	9,072.09
8 to 10" "	100,497	.060	5,940.20	6,077.24
10 to 12" "	52,877	.092	5,337.91	4,504.99
12 to 14" "	18,260	.105	1,923.32	1,175.16
Athens Treated Timber	2,502	.211	528.96	1,929.75
Total Timber - 1930	278,439	.0671	18,690.93	
Total Timber - 1929	370,656	.0614		22,759.23
7' Lagging	1,573,128	.737	11,600.02	10,991.09
Poles - 9 $\frac{1}{2}$ '	771,035	1.431	11,038.39	9,224.06
Cover Boards - 1"	7,602	1.79	136.07	357.52
Wire Fencing (1620 rods) sq.ft.	111,375	.781 Rd	1,266.53	
Total - 1930			24,041.01	
Total - 1929				20,572.67
Grand Total - 1930			42,731.94	
Grand Total - 1929				43,322.90
Product			416,653	331,922
Feet of timber per ton of ore			.6682	1.1167
Feet of lagging per ton of ore			3.7756	4.474
Feet of poles per ton of ore			1.8505	1.849
Feet of lagging per foot of timber			5.6500	4.007
Feet of wire fencing per ton of ore (207,629 tons) sq.ft.			.5364	-
Cost per ton for timber			.0449	.0671
" " " " lagging			.0278	.0331
" " " " poles			.0265	.0278
" " " " cover boards			.0003	.00107
" " " " wire fencing (in use 6 months)			.0030	-
" " " " all timber and wire			.1025	.1305

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7. UNDERGROUND:d. Timbering: (Cont)Statement of Timber Used: (Cont)

	AMOUNT <u>1930</u>	AMOUNT <u>1929</u>
Equivalent of Stull timber to board measure	485,484	574,369
Feet of board measure per ton of ore	1.165	1.73
 Total cost for timber, lagging, poles, cover boards, and cost per ton:		
1930	\$ 41,465.41	\$.0995
1929	43,332.70	.1305
1928	28,083.62	.1074
1927	23,097.31	.0855
1926	22,163.56	.0906
1925	11,011.51	.0736
1924	17,199.67	.0760

e. Drifting and Raising:

The raising during the year was confined to the 3rd and 4th levels, while drifting was in progress on the 2nd, 3rd, and 4th levels.

The following is a statement of drifting and raising on the main levels for the years 1930 and 1929:

	<u>Drifting</u>		<u>Raising</u>		<u>Total</u>
	<u>Ore</u>	<u>Rock</u>	<u>Ore</u>	<u>Rock</u>	
1930	1,240'	898'	2,028'	138'	4,304'
1929	1,125'	1,076'	2,306'	508'	5,015'
Increase	115'				
Decrease		178'	278'	370'	711'

f. Explosives, Drilling and Blasting:

The amount of powder used in 1930 increased due to larger production. The cost per ton for powder decreased due to less pounds used per ton of ore. There was less ore raising in 1930, and more ore produced per foot of advance on the sub levels where 9 ft. legs were in general use. No more powder is required when using 9 ft. legs so this is one of the factors that caused the decrease in pounds of powder per ton of ore, and decreased the cost per ton.

Statement of Explosives Used:

	<u>Ore Development and Stopping</u>		<u>1930</u>	<u>1929</u>
	<u>Quantity</u>	<u>Average Price</u>	<u>Amount</u>	<u>Amount</u>
50% Am. Gel.	51,850	.1295	6,713.87	11,774.00
60% " "	81,100	.1400	11,355.58	6,342.88
1-x and 2-x	22,900	.1273	2,914.27	-
Total Powder - 1930	155,850	.1346	20,983.72	
Total Powder - 1929	135,250	.1340		18,116.88
 Fuse	816,007	.375	3,056.02	2,687.77
Caps - #6	84,379	1.154	973.36	803.97
Cap Crimpers				2.01
Powder Bags	48	2.36	113.40	88.80
Total Fuse, etc. - 1930			4,142.78	
Total Fuse, etc. - 1929				3,582.55

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7. UNDERGROUND:f. Explosives, Drilling and Blasting: (Cont)Statement of Explosives Used: (Cont)

	1930	1929
	<u>Amount</u>	<u>Amount</u>
Total All Explosives - 1930	25,126.50	
Total All Explosives - 1929		21,699.43
Product	416,653	331,922
Pounds of powder per ton of ore	.3740	.4075
Cost per ton for powder	.0503	.0546
" " " " fuse, caps, etc.	.0100	.0108
" " " " all explosives	.0603	.0654
<u>Rock Development, etc.</u>		
	Average	
	Quantity	Price
		1930
		1929
		<u>Amount</u>
		<u>Amount</u>
50% Am. Gel.	1,100	.1291
		142.00
60% Am. Gel.	6,250	.1418
		886.06
1-x and 2-x	50	.1276
		6.38
Total Powder - 1930	7,400	.1398
		1,034.44
Total Powder - 1929	11,350	.1400
		1,589.11
Fuse	20,370	
		117.94
Caps - #6	3,321	
		37.54
Total Fuse, etc. - 1930		155.48
Total Fuse, etc. - 1929		319.52
Total - 1930		1,189.92
Total - 1929		1,908.63
Total Explosives used in mine - 1930		26,316.42
Total Explosives used in mine - 1929		23,608.06
Average price per pound for powder		.13487
		.13442
65% of all powder used in 1930 was 60%		
40% " " " " " 1929 " 60%		

g. Mining and Loading:

	1930	1929	1930 % of	1929 % of
	<u>Tons</u>	<u>Tons</u>	<u>Product</u>	<u>Product</u>
Hand Shovelling	-	31,192	-	10%
Scrapers	400,217	280,730	100%	90%
Total	400,217	311,922	100%	100%

There were no changes in mining methods in 1930. Some of the details of the work were improved, namely, more careful selection of size of timber suitable to the pressure, more general use of 9' legs and in some areas 9' caps, more attention given to covering down, more care taken to protect miners advancing in heavy loose ground, and to use of higher powered scraper hoists. Experiments are now under way with larger scrapers for the 15 and 20 h. p. hoists. This is practically the only way that tons per man per day can be increased and cost per ton decreased. All the mining organizations are working on this problem and it seems probable that more powerful hoists will come into general use within a short time. The 15 h.p. unit is the lowest power now being purchased; many 20 h.p. hoists with higher speeds are going in service and in some districts 25, 30 and 35 h. p. hoists are being tried out.

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7. UNDERGROUND:

i. Ventilation:

The joint ventilation of the Maas-Negaunee Mines controlled by a fan on surface at No. 2 shaft, Negaunee Mine, was improved by a connection between the 2nd level Maas and 10th level Negaunee. This makes three connections, mainly in rock, between the two mines. The Maas Mine shaft is the main outlet for the air and the passage through the mine has been controlled by an arrangement of doors installed from time to time during the year as needed to force the air through the sub and down another. Ventilation in some areas was only possible by use of booster fans drawing air from the main airway and forcing it up a raise and to the working face. Five of these booster fans were in service on the 4th level at the end of the year and others will have to be added from time to time.

j. Pumping:

The number of gallons pumped per minute during 1930, 1929, and 1928, are shown below:

<u>Month</u>	<u>1930</u>	<u>1929</u>	<u>1928</u>
January	1,101	1,076	1,055
February	1,042	1,089	1,043
March	1,036	1,075	1,100
April	1,080	1,009	1,123
May	1,094	1,023	1,095
June	1,109	1,014	1,067
July	1,106	1,018	993
August	1,095	1,030	973
September	1,103	1,062	986
October	1,202	1,102	1,014
November	1,147	1,064	1,109
December	<u>1,108</u>	<u>1,058</u>	<u>1,071</u>
Total Average	1,102	1,052	1,052

The water pumped at the Maas increased during the year, the increase amounting to 50 gallons per minute, due to shifting and blocking in the caved portion of the ledge as the amount of water pumped in the Negaunee Mine decreased.

The average number of gallons pumped per minute over the last six years is as follows:

<u>Year</u>	<u>Gals. per minute</u>
1930	1,102
1929	1,052
1928	1,052
1927	1,013
1926	970
1925	915

k. Underground in General:

Early last summer it was decided to use wire netting to help keep back the rock and tie the mat closer together. The wire is a regular fence type with 4" diamond mesh; it has been used in 42" and 50" widths. Usually six poles or more are laid on the bottom of the drift and covered with strips of wire the entire length of the slice, with the wire overlapping 3". The wire also extends up on the sides far enough to allow for bending down around the legs to completely cover the space between the slices. It is fastened with $2\frac{1}{2}$ "

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7. UNDERGROUND:k. Underground in General: (Cont)

staples to the poles and under new ground is further reinforced with poles or lagging. Near jasper or dikes the wire is placed on sides and extended to the top of the drift and blocking placed against it to keep the rock out of the sub below. The wire fencing has proven very satisfactory in keeping the rock out, which formerly caused runs and delayed the contract in completing their cycle and also reduced the grade of the ore.

9 ft. legs and in some areas 9 ft. caps have been used more extensively this year, thus giving more ore for very little additional timber, powder, or work.

New rocker dump cars have been installed on all the main levels to take the place of the old saddleback cars. These new cars have proven very satisfactory and have reduced both car repairing and track cleaning on the main levels to a minimum. The pockets at shaft have been rearranged to accommodate the new cars, the track having been shifted to one side of the pocket opening and a buffer built to absorb the shock of dumping the car and protect the frame.

A new 6" air line was installed on the 4th level from the shaft to the ore body to replace the old 4" line, also a 4" line was installed on the 3rd level to supplement the 3" line from the shaft crosscut to the Negaunee boundary in the footwall drift. All the pipes in the raises have been increased to 2" and connections have been made between the air lines on the levels to maintain a more constant pressure and air supply.

A Conway loader was purchased for use on the 5th level, but did not prove very satisfactory as the maintenance was very high due to breakage.

Two pumps were installed during the year in the 3rd level pumphouse. These pumps were purchased from the Stephenson Mine equipment and consisted of 1 Allis Chalmers 6-stage pump, 400 h. p. and 1060' head, with a Cutler Hammer 400 h. p. starter, and 1 Allis Chalmers 50 h. p., 1,000 gal. per minute, 120' head.

8. COST OF OPERATING:a. Comparative Mining Costs:

	1930	1929	Increase	Decrease
PRODUCT	416,653	331,922	84,731	
Underground Costs	1.272	1.391		.119
Surface Costs	.152	.148	.004	
General Mine Expenses	.205	.243		.038
Cost of Production	1.629	1.782		.153
Depletion - Original Cost	.073	.073		
Increment	-	-		
Depreciation - Plant & Equipt.	.046	.046		
Development	.039	.039		
Movable Equipt.	.002	.003		.001
Taxes	.313	.344		.031
Loading and Shipping	.020	.037		.017
Total Cost at Mine	2.122	2.324		.202
Administrative & General Expenses	-	-		
Miscellaneous Income	-	-		
Obsolete Supplies	.001	-	.001	
Supply Inventory Adjustment	-	-		
Total Cost	2.123	2.324		.201
No. of Days Operated	278	292		14
No. Shifts & Hours	1-8 hr	1-8 hr		
Average Daily Product	1,499	1,137	362	

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8. COST OF OPERATING:

a. Comparative Mining Costs: (Cont)

COST OF PRODUCTION:

	1930	%	1929	%	Incr.	Decr.
Labor	.851	52.2	.939	56.8		.088
Supplies	.778	47.8	.843	43.2		.065
Total	1.629	100.0	1.782	100.0		.153

b. Detailed Cost Comparison:

(1) Days and Shifts:

Year	Days Worked	Shifts & Hours	Men Employed	Total Days Worked
1930	278	1-8 hr	233½	68,061
1929	292	1-8 hr	208	62,146
Increase			25½	5,915
Decrease	14			

(2) Wages:

The mine operated on the same wage schedule in 1930 as in 1929.

(3) Comparison of Production:

Production - 1930	416,653 tons
Production - 1929	331,922 "
Increase	84,731 "

(4) Comparison of Number of Men and Wages:

	No. Men	No. Days	Amount	Rate per day
1930	233½	68,061	346,559.82	5.10
1929	208	62,146	305,645.40	4.92
Increase	25½	5,915	40,914.42	.18

(5) Tons per man per day:

The tons of ore mined per man per day were as follows:

	1930	1929	Increase	Decrease
Surface	30.82	25.26	5.56	
Underground	7.64	6.77	.87	
Total	6.12	5.34	.78	

(6) Cost of Production:

1930	\$678,818.53	Cost per ton	\$1.629
1929	591,286.51	" " "	1.782
Increase	87,532.02	Decrease	.153

	Total Cost				Cost per ton		
	Labor	%	Supplies	%	Labor	Supplies	Total
1930 -	\$354,456.91	52.2	\$324,361.62	47.8	\$.851	\$.778	\$1.629
1929 -	311,831.15	52.7	279,455.36	47.3	.939	.843	1.782
Incr.	42,625.76		44,906.26	.5			
Decr.		.5			.088	.065	.153

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8. COST OF OPERATING:

b. Detailed Cost Comparison: (Cont)

(7) Detail of Accounts:

UNDERGROUND COSTS:

Exploring in Mine:

1930 Amount	\$271.43	Cost per ton	\$.001
1929 Amount	<u>458.05</u>	" " "	<u>.001</u>
Decrease	186.62		

This charge covers Geological Department expense for the Maas Mine. This expense was less in 1930.

Development in Rock:

1930 Amount	\$ 6,176.03	Cost per ton	\$.015
1929 Amount	<u>10,714.53</u>	" " "	<u>.032</u>
Decrease	4,538.50		.017

	<u>Sub Division</u>			
	<u>Drifting</u>	<u>Raising</u>	<u>Total Ft.</u>	<u>Cost per Ft.</u>
1930	898'	138'	1,036	\$ 5.96
1929	<u>1,076'</u>	<u>508'</u>	<u>1,584</u>	<u>6.76</u>
Decrease	178'	370'	548	.80

The decrease is due to less rock drifting and raising in 1930. The cost per foot was also lower.

Development in Ore:

1930 Amount	\$19,786.76	Cost per ton	\$.047
1929 Amount	<u>24,636.18</u>	" " "	<u>.074</u>
Decrease	4,849.42		.027

	<u>Sub Division</u>			
	<u>Drifting</u>	<u>Raising</u>	<u>Total Ft.</u>	<u>Cost per Ft.</u>
1930	1,240'	2,028'	3,268	\$ 6.06
1929	<u>1,125'</u>	<u>2,306'</u>	<u>3,431</u>	<u>7.18</u>
Increase	115'			
Decrease		278'	163	1.12

The decrease is due to less ore raising in 1930 and to lower cost per foot.

Stoping:

1930 Amount	\$176,022.41	Cost per ton	\$.422
1929 Amount	<u>146,437.67</u>	" " "	<u>.442</u>
Increase	29,584.74	Decrease	.020

	<u>Detail</u>		
	<u>Labor</u>		<u>Supplies</u>
1930	\$123,583.97	70%	\$52,438.44 30%
1929	102,807.54	70%	43,630.13 30%

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8. COST OF
OPERATING:

stoping: (Cont)

	<u>Cost per Ton</u>		<u>Total</u>
	<u>Labor</u>	<u>Supplies</u>	
1930	\$.296	\$.126	\$.422
1929	.310	.132	.442
Decrease	.014	.006	.020

The following double drum tugger hoists were charged in 1930:

5 - 15 h.p. Sullivan Hoists - cost	\$ 5,800.00
4 - 15 " Ingersoll-Rand Hoists - cost	<u>5,000.00</u>
	10,800.00
Cost of scraper hoists purchased in 1929	12,121.45
Cost of ropes for scraper hoists	3,020.25
Tons per foot for scraper rope	10.8
Cost per ton for scraper rope	.007

The cost for all explosives was .0051 lower in 1930. The cost per ton for labor decreased due to use of larger scraper hoists, more 9 ft. legs and caps, and to an improvement in operating conditions on some of the sub levels. Supply cost decreased due to less expenditures for scraper hoists and less cost for explosives.

Timbering:

1930 Amount	\$137,699.09	Cost per ton	\$.331
1929 Amount	<u>114,826.85</u>	" " "	<u>.347</u>
Increase	22,872.24	Decrease	.016

Detailed Cost of Timber

	<u>1930</u>	<u>1929</u>
Timber Cost	18,690.93	22,759.23
Lagging, poles, cover boards & wire	<u>24,041.01</u>	<u>20,573.67</u>
Total	42,731.94	43,332.90

Feet of timber per ton of ore	.6682	1.1167
Feet of lagging per ton of ore	3.7756	4.474
Feet of poles per ton of ore	1.8505	1.894
Cost per ton for all timber	.0995	.1305
Sq. Ft. of wire fencing per ton of ore	.5364	-
Cost per ton for wire fencing	.0030	-

Grand Total Cost all timber and wire fencing .1025

Labor Cost - 1930	\$85,750.35
" " - 1929	<u>64,700.47</u>
Increase - 1930	21,049.88

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8. COST OF
OPERATING:

Timbering:

The increase is due to more labor expense for timbering in 1930, also more expense for supplies other than timber, lagging, poles, and wire fencing. The amount of stull timber used in 1930 increased 24,925 lineal feet but due to lower prices per foot the cost was practically the same as in 1929. The amount of cribbing timber used in 1930 decreased over 50% to the amount of \$4,111.55. There were more regular timbermen and repair men employed in 1930.

The cost per ton decreased due to larger product.

Tramming:

1930 Amount	\$37,235.76	Cost per ton	\$.089
1929 Amount	<u>34,664.30</u>	" " "	<u>.104</u>
Increase	2,571.46	Decrease	.015

Increase due to 84,731 tons more ore trammed. Decrease in cost per ton due to larger product.

Ventilation:

1930 Amount	\$5,395.58	Cost per ton	\$.013
1929 Amount	<u>3,091.22</u>	" " "	<u>.009</u>
Increase	2,304.36	Increase	.004

Increase due to two new Anaconda booster fans charged in 1930, none in 1929; also more ventube and spiral riveted ventilation pipe charged out. Greater proportion of expense of operating joint Negaunee and Maas fan in December due to Maas working five days and Negaunee four days per week. The joint ventilation fan was also operated more on the night shift in 1930.

Pumping:

1930 Amount	\$50,606.54	Cost per ton	\$.121
1929 Amount	<u>48,354.36</u>	" " "	<u>.147</u>
Increase	2,252.18	Decrease	.026

Total gallons of water pumped	<u>1930</u>	<u>1929</u>
	577,702,994	554,452,221
Gallons pumped per minute	1,115	1,052

Increase in cost due to 63 gallons per minute more water pumped in 1930. Decrease in cost per ton due to larger product.

Compressors & Air Pipes:

1930 Amount	\$50,039.64	Cost per ton	\$.120
1929 Amount	<u>42,605.83</u>	" " "	<u>.128</u>
Increase	7,433.81	Decrease	.008

	<u>Compressors</u>	<u>Air Pipes</u>
1930	\$43,171.19	\$6,868.45
1929	<u>36,617.90</u>	<u>5,987.93</u>
Increase	6,553.29	880.52

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8. COST OF
OPERATING:

Compressors & Air Pipes: (Cont)

Total cu. ft. of air used in 1930	1,374,390,000
" " " " " " " 1929	1,067,265,000
Cubic feet per ton of ore - 1930	3,299
" " " " " " - 1929	3,215

Increase due to operating the second compressor more hours in 1930 and more underground air piping, installing 6" pipe line on 4th level and additional 4" line on 3rd level, also 6" air line in the 5th level drift. The total air used in 1930 and 1929 includes air used in sinking shaft, cutting plat on 5th level and drifting to ore body.

Back Filling:

1930 Amount	\$269.88	Cost per ton	\$.001
1929 Amount	<u>477.61</u>	" " "	<u>.001</u>
Decrease	207.73		

Decrease due to less expense for breaking filling in 1930.

Underground Superintendence:

1930 Amount	\$14,157.05	Cost per ton	\$.034
1929 Amount	<u>13,748.63</u>	" " "	<u>.043</u>
Increase	408.42	Decrease	.009

Increase due to new system of figuring daily wage of shift bosses, also includes the bonus paid them for each two week period in which no accident occurred.

Cave-In

1930 Amount	\$106.88	Cost per ton	\$.000
1929 Amount	<u>-</u>	" " "	<u>-</u>
Increase	106.88		

The 1930 charge is for repairing fences around caves.

MAINTENANCE ACCOUNTS:

Compressors & Power Drills:

1930 Amount	\$6,535.67	Cost per ton	\$.016
1929 Amount	<u>1,299.45</u>	" " "	<u>.004</u>
Increase	5,236.22		.012

	<u>Compressors</u>	<u>Power Drills</u>	<u>Air Lines</u>
1930	\$ 987.26	\$ 5,049.30	\$499.11
1929	<u>287.70</u>	<u>856.18</u>	<u>155.57</u>
Increase	709.56	4,193.12	343.54

Drills charged in 1930:

27 RB-12 Ingersoll-Rands	\$4,625.62
1 " " " jackstoper	252.36
1 AlB Cleveland Rock Drill	<u>171.32</u>
	5,049.30

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8. COST OF
OPERATING:

Compressors & Power Drills: (Cont)

Drills charged in 1929

5 ALAD Cleveland Rock Drills \$856.18

Increase due to more repairs to compressors, more drill machines purchased (as shown above) and more repairs to shaft air lines.

Electric Tram Equipment:

1930 Amount	\$20,217.34	Cost per ton	\$.049
1929 Amount	<u>15,716.32</u>	" " "	<u>.047</u>
Increase	4,501.02		.002

	<u>Sub Division</u>				
	<u>Gen. & Motors</u>	<u>Locomotives</u>	<u>Wiring</u>	<u>M. L. Tracks</u>	<u>M. L. Cars</u>
1930	<u>142.94</u>	<u>3,198.96</u>	<u>1343.57</u>	<u>6457.13</u>	<u>9074.74</u>
1929	<u>171.81</u>	<u>2,984.48</u>	<u>1656.46</u>	<u>8294.67</u>	<u>2608.90</u>
	28.87	214.48	312.89	1837.54	6565.84
	Decr.	Incr.	Decr.	Decr.	Incr.

Increase due to more repairs to locomotives and 16 new rocker dump motor cars, cost \$7,780.67, charged in 1930 at rate of two per month. There were less repairs to Generator & Motors and less expense for Wiring in 1930.

Pumping Machinery:

1930 Amount	\$5,608.42	Cost per ton	\$.013
1929 Amount	<u>5,070.44</u>	" " "	<u>.015</u>
Increase	537.98	Decrease	.002

Increase due to installing additional pumps in the main pumping plant on the 3rd level. Two centrifugal pumps were installed in 1930. Repairs to the main plunger pump were underway at the end of the year.

Total Underground Costs:

1930 Amount	\$530,128.48	Cost per ton	\$1.272
1929 Amount	<u>416,666.34</u>	" " "	<u>1.391</u>
Increase	113,462.14	Decrease	.119

Expenditures increased 27% in 1930, but due to the larger product the cost per ton decreased over 8%.

SURFACE COSTS:

Hoisting:

1930 Amount	\$25,904.09	Cost per ton	\$.061
1929 Amount	<u>21,177.34</u>	" " "	<u>.063</u>
Increase	4,726.75	Decrease	.002

Electric Power - 1930	\$18,685.56	Cost per ton	\$.045
Electric Power - 1929	<u>14,523.90</u>	" " "	<u>.044</u>
Increase	4,161.66		.001

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8. COST OF
OPERATING:

Hoisting: (Cont)

Increase due to more electric current consumed. There was an increase in the amount used by both the skip hoist and cage hoist. The increase for skip hoist is due to more product hoisted. The increase for cage hoist is due partly to the sinking cage which was in use three months in 1929 and seven months in 1930. It was hung under the main cage.

Stocking Ore:

1930 Amount	\$9,852.27	Cost per ton	\$.024
1929 Amount	<u>5,385.46</u>	" " "	<u>.016</u>
Increase	4,466.81		.008

Tons stocked - 1930	262,696
" " - 1929	131,372

Increase due to stocking more ore, making it necessary to erect more stocking trestle. Stocking started in August 1930.

Dry House:

1930 Amount	\$6,498.35	Cost per ton	\$.016
1929 Amount	<u>6,573.40</u>	" " "	<u>.020</u>
Decrease	75.05		.004

Coal to Boiler House:		<u>Tons</u>	<u>Cost</u>
1930	606½	@ \$5.23	\$3,172.00
1929	577	@ 5.28	<u>3,045.86</u>
Increase	29½		126.14

Decrease due to less working days in 1930.

General Surface Expense:

1930 Amount	\$5,555.02	Cost per ton	\$.013
1929 Amount	<u>4,194.96</u>	" " "	<u>.013</u>
Increase	1,360.06		

Increase due to Maas Mine proportion of expense for Chief of Police charged to this account in 1930 and preparing parking area for employees' cars West of the office.

MAINTENANCE ACCOUNTS:

Hoisting Equipment:

1930 Amount	\$7,382.10	Cost per ton	\$.018
1929 Amount	<u>2,915.18</u>	" " "	<u>.009</u>
Increase	4,466.92		.009